Can a brief behavioural assessment and tailored exercise adherence strategies improve adherence to exercise for older people with musculoskeletal conditions? A feasibility randomised controlled trial

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Abstract

Prescribed exercise is a widely used and effective treatment for older people with musculoskeletal conditions. However, its effectiveness may be limited by adherence or non-adherence to exercise programmes. It is important to develop an understanding of how clinicians can help people change their behaviour and adhere better to their prescribed exercise programmes. The four work packages undertaken as part of this thesis aim to determine what approaches have been currently tested, in addition to exploring the exercise adherence experiences of patients and physiotherapists, in order to inform the development of a theoretically underpinned exercise adherence intervention.

Work package one, a systematic review of exercise adherence interventions for older people tested in randomised controlled trials found eleven studies. These studies were categorised based on the interventions they tested using a pre-defined and published behaviour change technique taxonomy. Interventions that were categorised in the Feedback and Monitoring category demonstrated positive results, with three separate studies reporting significantly better adherence to exercise compared to controls. However, the generalizability of these results is limited by the risk of bias. Four of the included studies offered a theoretical justification for their intervention, the other seven did not. The review concluded with the need for improved use, reporting and development of theoretically underpinned interventions in the field of exercise adherence for older people.

Work package two, a qualitative study explored how adherence and non-adherence affects physiotherapists and their practice. There are several approaches with the potential to help facilitate adherence to exercise that are underpinned by the interaction between clinicians and patients. It is therefore important to explore this problem from both sides. In the findings, physiotherapists outlined that this is a challenging area of practice, one where they need to be resilient. They spoke about the importance of knowing each individual patient and building a rapport with them. In addition to discussing a range of practical steps they try and take to facilitate improved exercise adherence. The findings highlight the need for robust interventions to help clinicians in this area.

Work package three involved the development and testing of a theoretically underpinned exercise adherence intervention for older people with musculoskeletal conditions: The Adherence for Exercise Rehabilitation in Older People (AERO) intervention. This was developed using an Intervention Mapping approach and was underpinned by the COM-B model of behaviour change. It involved offering individually tailored exercise adherence strategies based on a behavioural assessment undertaken as part of a routine physiotherapy appointment. The feasibility, acceptability and thus potential of this new intervention was tested in a feasibility randomised controlled trial involving 48 participants. The intervention and associated trial procedures were found to be feasible.

The fourth and final work package consisted of a second qualitative study to investigate the overall acceptability of the AERO trial and to explore exercise adherence from the patient's perspective. Patients discussed their experience of trying to adhere to an exercise programme and the acceptability of AERO and all its procedures. Some suggestions to consider in a future randomised controlled trial were also outlined along with the difficulties of adhering to exercise programmes. Patients outlined the importance of the approach taken by the physiotherapist, being recognised as an individual, and having a good working relationship with the physiotherapist.

This research has shown the importance of exercise adherence for older people with musculoskeletal conditions, the lack of theoretically underpinned interventions in the literature, the challenge that exercise adherence is for both patients and clinicians, and the feasibility of delivering tailored exercise adherence strategies to individual patients based on a brief behavioural assessment. There are several considerations outlined across the work packages that could be of importance to physiotherapists in clinical practice, including monitoring and feedback and the therapeutic relationship. However there remains the need for robust interventions in this area to help clinicians to facilitate better adherence to prescribed exercise. The AERO intervention was tested for its feasibility and acceptability and should now be tested in a robust appropriately powered randomised controlled trial.

Publications and conference proceedings relevant to this thesis

Room J, Dawes H, Boulton M, Barker K (2019) 'Can a brief behavioural assessment improve exercise adherence in older people with musculoskeletal conditions? A feasibility randomised controlled trial'. *Conference Proceedings Physiotherapy UK 2019* № 26

Room J, Boulton M, Dawes H, Barker K (2019) 'Development of an exercise adherence intervention for older people. The steps taken designing a complex intervention for the AERO trial'. *Conference Proceeding WCPT* 2019 PO-J-09-SUN1

Room J, Martin J, Archer K, Boulton M, Dawes H, Barker K (2019) 'Physiotherapists' perceptions of how exercise adherence affects their practice: a qualitative study'. *Conference Proceeding WCPT* 2019 PO-E-08-SUN2

Room J, Hannink E, Dawes H, Barker KL (2017) 'What interventions are used to improve exercise adherence in older people and what behavioural techniques are they based on? A systematic review'. *BMJ Open* 7(12):e019221 DOI: 10.1136/bmjopen-2017-019221

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Glossary

6SQuID	Six Steps for Quality Intervention Development
AERO	Adherence for Exercise Rehabilitation in Older People
AS	Ankylosing Spondylitis
BCT	Behaviour Change Technique
BCTs	Behaviour Change Techniques
BCTTv1	Behaviour Change Technique Taxonomy version 1
BCW	Behaviour Change Wheel
BREQ3	The Behavioural Regulation in Exercise Questionnaire
CBT	Cognitive Behavioural Therapy
COM-B	Capability, Opportunity, Motivation, Behaviour
CONSORT	Consolidated Standards of Reporting Trials
COPD	Chronic Obstructive Pulmonary Disease
COREQ	Consolidated Criteria for Reporting Qualitative Studies
EARS	Exercise Adherence Rating Scale
FREC	Faculty Research Ethics Committee
GROC	Global rating of Change
HAPA	Health Action Process Approach
IPA	Interpretative Phenomenological Analysis
LTCs	Long Term Conditions
MECC	Make Every Contact Count
MRC	Medical Research Council
MSK	Musculoskeletal
NASS	National Ankylosing Spondylitis Society
NICE	National Institute for Health and Care Excellence
NHS	National Health Service
OA	Osteoarthritis

OR	Odds Ratio
PASE	Physical Activity Scale for the Elderly
PI	Principal Investigator
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
RA	Rheumatoid Arthritis
RAI	Relative Autonomy Index
RCT	Randomised Controlled Trial
RCTs	Randomised Controlled Trials
REC	Research Ethics Committee
SEE	Self-Efficacy for Exercise Scale
SF-36	36-Item Short Form Survey
TFI	Tilburg Frailty Indicator
VAS	Visual Analogue Scale
WHO	World Health Organisation
WOMAC	The Western Ontario and McMaster Universities Arthritis Index
YLDs	Years lived with disability

1 Introduction

This thesis sets out to develop and evaluate an intervention to help clinicians facilitate better adherence to prescribed exercise in older people with musculoskeletal (MSK) conditions. Older people commonly present with one or more long term MSK conditions for which exercise programmes are an integral part of treatment. Although there is evidence for improved clinical outcomes with exercise limited adherence to exercise programmes may limit their effectiveness. In order to realise the full potential of exercise programmes, consideration needs to be given to improving adherence to prescribed exercise. To date, there is limited research looking at interventions to improve adherence for prescribed exercise in older people.

Although we are aware of many of the factors associated with those who have good or poor adherence to exercise programmes, we need to develop an understanding about what clinicians can do to try and help people change their behaviour and better adhere to prescribed exercise.

1.1 Thesis overview

This thesis will explore the topic of exercise adherence interventions for older people with MSK conditions through four work packages. The first of these is a systematic review of exercise adherence interventions used with older people, tested in randomised controlled trials (RCTs). The second is a qualitative study exploring physiotherapists' perception of how adherence and non-adherence to prescribed exercise affects their practice. The third will present a feasibility RCT testing The Adherence for Exercise Rehabilitation in Older People (AERO) intervention. This intervention was developed as part of this work package and aims to improve exercise adherence in older people with MSK conditions. Finally, the fourth work package is a piece of qualitative work that took place following the feasibility RCT. It will describe patients' views on the intervention tested, in addition to their experience of trying to adhere to an exercise programme.

1.2 Overview of chapters

- **Chapter one** will give an introduction and overview of the thesis
- **Chapter two** discusses the relevant literature and gives an overview and definitions of the concepts relevant to the thesis
- **Chapter three** describes a systematic review of exercise adherence interventions that have been evaluated in RCTs for older people (work package one). Interventions are described and categorised using a behaviour change taxonomy. The effectiveness of the interventions are presented as standalone studies, and are also considered on the basis of the behaviour change taxonomy categories they belong to
- **Chapter four** presents a qualitative study (work package two) outlining physiotherapists' perceptions of how adherence and non-adherence to prescribed exercise affects their practice. Their views of the topic in general are considered, but also how they respond when faced with the challenge of non-adherent patients
- **Chapter five** outlines the steps taken in the design of an evidence-based exercise adherence intervention that can be used by clinicians to target adherence strategies to the individual patient. An Intervention Mapping process was used and is described
- **Chapter six** presents a feasibility RCT (work package 3) entitled *Individually tailored exercise adherence strategies based on a brief behavioural assessment for older people with*

musculoskeletal conditions. A feasibility randomised controlled trial. Both feasibility outcomes and outcomes relevant to exercise adherence and the behavioural regulation of exercise are described

- **Chapter seven** reports a qualitative study (work package 4), in which participants describe their experience of attempting to follow an exercise programme. This is in addition to their experience of the intervention as described in chapters five and six
- **Chapter eight** gives a summary and implications of the research outlined in this thesis before discussing areas for future research

1.3 Thesis aims and objectives

The overall aim of this thesis is to determine if it is feasible for physiotherapists to offer targeted exercise adherence strategies to older adults with MSK conditions based on a behavioural assessment.

The objectives are:

- To determine what interventions are used to improve adherence to exercise programmes in older people
- To review the effectiveness of these interventions
- To explore the experience of physiotherapists treating adherent and non-adherent patients and investigate how they feel this affects their practice
- To use an Intervention Mapping approach to develop an intervention to improve exercise adherence in older people that is theoretically underpinned and can be tailored to individual patients
- To establish the acceptability and feasibility of the new intervention
- To explore the experiences of older people attempting to adhere to an exercise programme

Hypotheses

- The AERO intervention developed for work package 3 will be feasible to use in a physiotherapy setting
- The AERO intervention developed for work package 3 will be acceptable to both physiotherapists and participants
- The AERO intervention will demonstrate the potential to improve exercise adherence compared to usual care, although in a feasibility design it may not be possible to conclusively demonstrate this

2 Literature review

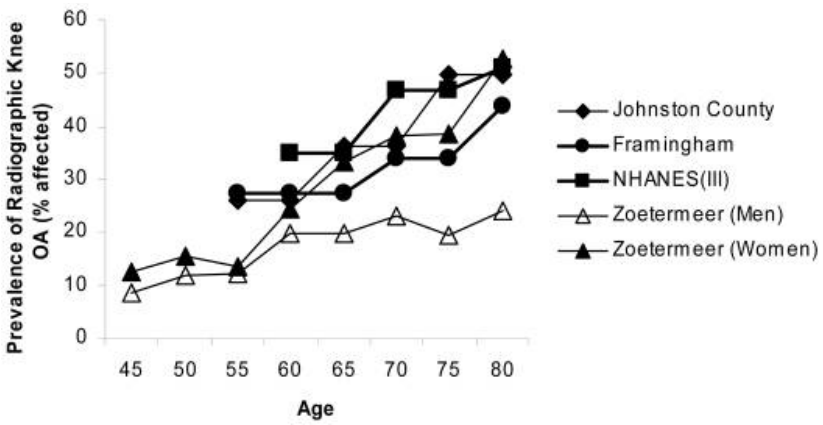
2.1 Musculoskeletal conditions, exercise and older people

Exercise is a commonly prescribed treatment modality in a number of MSK conditions, including but not limited to osteoarthritis (OA) of the hip and knee (Bennell and Hinman 2011, Hoffmann et al 2016, Uthman et al 2013), post total knee arthroplasty (Henderson et al 2018), post total hip arthroplasty (Coulter et al 2013), back pain (Hoffmann et al 2016, Angela Searle et al 2015), neck pain (Bertozzi et al 2013, O'Riordan et al 2014), shoulder conditions such as rotator cuff impingement (Kuhn 2009) or subacromial impingement syndrome (Hanratty et al 2012), and for the prevention of falls (Hoffmann et al 2016). In addition, exercise is of benefit in conditions such as diabetes (Colberg et al 2016), heart disease (Gielen et al 2015, Hoffmann et al 2016), chronic obstructive pulmonary disease (COPD) (Hoffmann et al 2016), and chronic fatigue syndrome (Hoffmann et al 2016). Naci and Ioannidis (2013) conducted a meta-analysis of RCTs comparing exercise and drug interventions for a number of these conditions, reporting that the effectiveness of exercise is comparable to drug interventions.

MSK conditions have a significant economic and social impact. In England each year roughly 20% of the population consult a general practitioner regarding an MSK condition (Versus Arthritis 2019) along with an NHS spending of approximately £5 billion (Public Health England 2019). In 2017 it was estimated that 18.8 million people in the UK had an MSK condition with the prevalence increasing with age (Versus Arthritis 2019). For those aged 65-74, 75-84 and 85+ the prevalence was 51.6%, 53.8% and 54.0% respectively. However, for those aged 20-34 the prevalence was 19.0%. Alongside these figures it should be considered that older people may under report their conditions, for reasons such as seeing pain as a normal part of ageing (Podichetty et al 2003). Consideration also needs to be given to the fact that MSK conditions can have a detrimental effect on quality of life (Roux et al 2005) as measured by the Short Form-36 (SF-36) (Ware and Gandek 1998) scores, particularly in the physical domain.

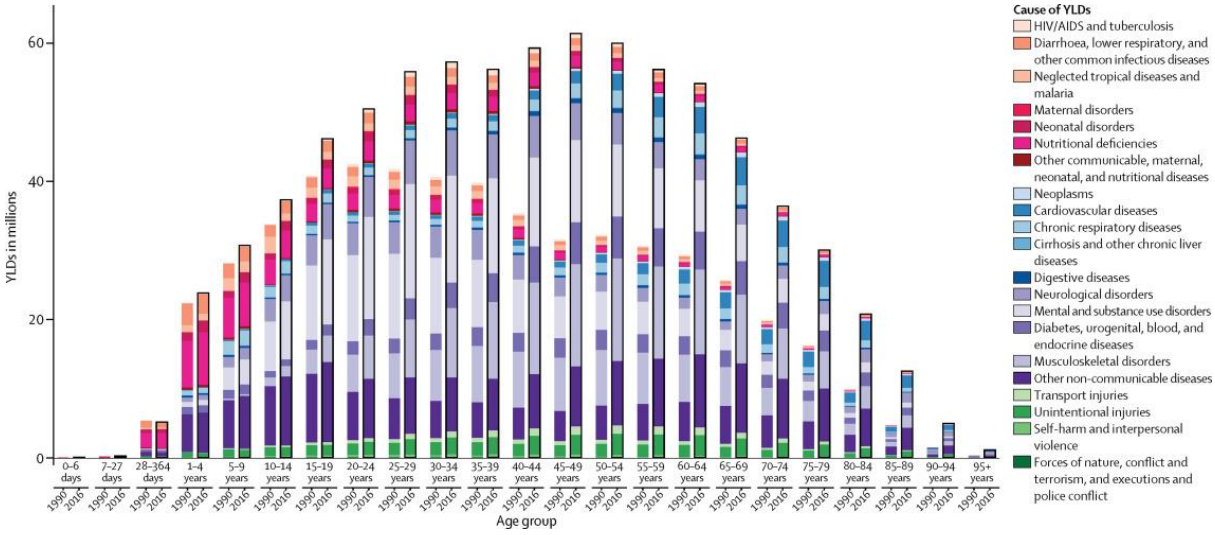
Figure 2.1 (Anderson and Loeser 2010) shows the increased prevalence and incidence of knee OA with age (Arden and Nevitt 2006) and is a good example of a specific MSK condition seen in the older population. It includes data from several previous studies (Dillon et al 2006, Felson et al 1987, Jordan et al 2007, van Saase et al 1989).

Figure 2.1 Prevalence of radiographic knee osteoarthritis plotted against age



For primary knee and hip arthroplasties, which include exercise programmes as a standard part of rehabilitation, the average age at surgery in the UK is 69 (IQR 61-76) and 69 (IQR 63-76) respectively (National Joint Registy 2018). Although not exclusively a condition that affects older people, low back pain is a leading cause of disability in adults over the age of 60 years (Wong et al 2017). For neck pain there is disagreement as to whether or not the risk of neck pain increases up to middle age, and then decreases with age, however neck pain is still a condition experienced by those over the age of 60 (Hogg-Johnson et al 2009). For shoulder complaints, Greving et al (2012) reported the incidence of patients with a shoulder complaint per 1000 person-years to be 22.2 (95% CI 21.32–23.10) for those aged 18-44, 40.2 (95% CI 38.50–41.95) for those aged 45-64, and 37.1 (95% CI 34.67–39.47) for those aged 65 or older, demonstrating that older people make up a large proportion of all shoulder complaints. Further to this an additional problem linked to older age is falling, the incidence of falling and associated injury increase with age (Berry and Miller 2008). The increase in prevalence of MSK conditions is important to consider in relation to the associated increase in burden. MSK conditions have significantly increased since the year 2000 with OA and back pain being the second largest cause of years lived with disability (YLDs) across the globe (Sebbag et al 2019). MSK conditions are one of the main reasons for YLDs in older age (Vos et al 2017), as can be seen in figure 2.2, for example, in 2016 MSK conditions accounted for 31,045,911.51 YLDs in the age categories of 65-69 years and above.

Figure 2.2 Global YLDs for 21 causes by age groups in 1990 and 2016 taken from Vos et al (2017)



2.1.1 Exercise definition

It is important to clarify the terminology and definitions for exercise. The terms exercise and physical activity are sometimes incorrectly interchanged. For clarity it would be helpful to define what is meant by exercise. In their seminal paper on exercise Caspersen et al (1985) defined physical activity, exercise and physical fitness.

Exercise is defined as a *'subset of physical activity. Exercise is physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective.*

This differs from physical activity which is *'any bodily movement produced by skeletal muscle that results in energy expenditure'*.

Physical fitness is defined as '*a set of attributes that people have or achieve that relates to the ability to perform physical activity'*.

These definitions help to differentiate exercise and physical activity. Where exercise is used in this thesis, it is used with the above definition in mind.

2.1.2 Exercise programmes and physiotherapy

Exercise is a common treatment option employed by physiotherapists (American Physical Therapy Association 2016, Chartered Society of Physiotherapy 2013a) but there is no definitive figure for the number of exercise programmes that are prescribed in a year. However some indication of the size of the figure can be given by considering that, in 2014 there were 23,006 physiotherapists in the UK (Chartered Society of Physiotherapy 2015) and 210,900 in the USA (Bureau of Labor Statistics 2015). Also, in the UK a survey of organisations who offer outpatient physiotherapy reported that of the 54% of organisations to respond 1,480,893 new patients were seen in a year (Chartered Society of Physiotherapy 2013b). The per hour unit of a band 6 physiotherapist in 2020 is £40.29 (Chartered Society of Physiotherapy 2017) so assuming the numbers of patients have stayed similar, and a new patient appointment lasts one hour, the total staff cost would be £59,665,179. This figure is likely to be an underestimation for two reasons, firstly 46% of organisations did not respond to the survey. Secondly, the unit cost given above is for an NHS physiotherapist and therefore will not take account of the additional cost of privately provided physiotherapy. However, with these numbers as a basis, it would be reasonable to assume that a significant number of exercise programmes are being prescribed by the physiotherapy profession annually, at a significant cost. This assumption appears to be confirmed by surveys of practice that report exercise as a frequently used treatment modality for a range of conditions (Artz et al 2013, Grieve and Palmer 2016, Palmer et al 2015, Rushton et al 2014, Smith et al 2011).

2.2 Adherence

The adjective adherent describes *'sticking firmly to something'* (Compact Oxford English Dictionary 2008).The origins of the word come from the Middle French word adherer meaning *'to stick, adhere'* or from the Latin word adhaerare, with the prefix ad meaning *'to'* and haerere *'to stick'* (Online Etymology Dictionary 2017). In a more medical context adherence is defined by the World Health Organisation (WHO) as the '*extent to which a person's behaviour corresponds with agreed recommendations from a health care provider'* (World Health Organisation 2003).

2.2.1 Adherence to exercise

Considering adherence specifically in relation to prescribed exercise, the WHO definition could be adapted to think about the ability and the extent to which a person undertakes an exercise programme as instructed by the health care professional in question. In previous studies exercise adherence has been found to be sub-optimal and Sluijs et al (1993), in their seminal paper, explored adherence in a cross sectional design. The authors gathered data in several ways. They collected 222 questionnaires completed by physiotherapists, audio recordings of treatment sessions from 84 physiotherapists, and 1,681 questionnaires completed by patients undergoing physiotherapy. They reported that 22% of patients were non-compliant and 41% partially compliant with their prescribed

exercises. Although there were limitations to the study, such as the self-reported exercise adherence measure, this study was the first to suggest a level of adherence to physiotherapy exercise programmes. Subsequently, similar figures have been reported by Alexandre et al (2002) and most recently by Peek et al (2020). The latter noted that 66% of participants self-reported being highly adherent to their prescribed physiotherapy exercise programme, where highly adherent was measured as completing more than 50% of what was prescribed. It is reasonable to ask the question, does this matter? What difference does it make if people do or do not complete their exercise programmes?

2.2.2 Exercise adherence and outcomes

Pisters et al (2010) conducted a prospective observational study to determine the extent to which adherence to physiotherapy prescribed exercise affected the outcomes of pain, physical function, and self-perceived effect of treatment, in those with hip or knee OA. The authors used generalised estimating equations to explore the relationship between exercise adherence and these variables. Participant data was obtained from a RCT testing two exercise interventions. When adjusting for treatment allocation the authors found adhering to exercise was associated with an improvement in pain of -0.966 (95% CI -1.642, -0.290 *p*=0.005), as scored on the pain subsection of The Western Ontario and McMaster Universities Arthritis Index (WOMAC) (McConnell et al 2001), an improvement in self-reported physical function of -2.385 (95% CI -4.338, -0.382 *p*=0.002), as measured by the physical function subscale of the WOMAC, and an improvement in physical function of -0.240 (95% CI -0.419 to -0.062 *p*=0.008), as measured by the 5 metre walking test. Adjusting for age, sex, location of symptoms, duration of symptoms and recruitment method, in addition to treatment allocation did not change the significance of the results. The association between adhering to exercise and self-perceived effect of treatment was not significant with reported results of an Odds Ratio (OR) of 1.327 (95% CI 0.852, 2.067 *p*=0.210), however this effect was significant after adjusting for the factors stated above, with results of 1.725 (95% CI 1.067, 2.788 *p*=0.026)

Van Gool et al (2005) investigated the effect of exercise adherence on walking distance and disability in overweight older adults with knee OA. The authors performed a secondary analysis using data from the ADAPT trial (Miller et al 2003) in which participants were allocated to either dietary weight loss, exercise, combined dietary weight loss and exercise, or a healthy lifestyle control group. Outcomes included knee pain, knee stiffness, physical function, and weight loss. The authors used multiple regression analysis to explore the association between adherence, walking distance and disability. The results showed that greater adherence was associated with an improvement in walking distance, as measured by the 6 minute walk test, at both 6 and 18 months, with results of 0.28 (95% CI 0.25, 1.07 *p*=0.002) and 0.39 (95% CI 0.48, 1.30 *p*=<0.001) respectively. Greater exercise adherence was also associated with an improvement in disability, as measured by the function subscale of WOMAC at 6 months, with results of -0.23 (95% CI -0.14, -0.03 p=0.001). At 12 months the association was not significant with results of -0.18 (95% CI -0.12, 0.00 *p*=0.052).

Both these studies analysed data that was collected for different questions related to a primary RCT meaning they may not be adequately powered to answer the secondary questions related to adherence. Also, both study designs allowed for associations to be explored but not for causality to be established. Therefore, a need remains for appropriately designed studies to demonstrate that improving exercise adherence brings about improvements in health related outcomes. However,

existing literature suggests that improving exercise adherence may affect outcomes such as physical function, pain, physical performance and self-perceived effect of treatment (Van Gool et al 2005, Pisters et al 2010). Alongside these outcomes it would also be helpful to consider quality of life. Roux et al (2005) reports that the onset of MSK conditions can have a detrimental effect on quality of life. However, exercise of multiple types, resistance training, flexibility exercise, and walking have all been associated with higher quality of life scores compared to those who do not exercise (Oh et al 2017), and higher exercise adherence has also been reported to be associated with improved quality of life scores (Imayama et al 2014), although this was not in older adults.

Although there is a need for robust research to demonstrate that improving exercise adherence improves health outcomes and quality of life, there is already some evidence to suggest that improving exercise adherence has the potential to enhance health related outcomes and quality of life.

2.2.3 Adherence to exercise and older people

Adherence to exercise is an important consideration for all populations. With regards to physiotherapy prescribed exercise programmes previous literature has highlighted some of the factors associated with sub-optimal adherence. A systematic review by Jack et al (2010) reported that adherence to treatment given in physiotherapy, including prescribed exercises, was affected by low baseline levels of physical activity, low in-treatment adherence, low self-efficacy, depression, anxiety, helplessness, poor social support, a greater number of perceived barriers to exercise and increased pain levels during exercise. However, there are a number of factors that make the subject of exercise adherence particularly important for older people. It is known that exercise adherence in those who are older is affected by their health status (Picorelli et al 2014) and older people are more likely to have one or more long term conditions (LTCs) (Department of Health 2012) for which exercise is a treatment option (Hoffmann et al 2016). In addition, their engagement in exercise is known to be poor following discharge from hospital (Hill et al 2011), or discharge from physiotherapy (Forkan et al 2006).

There are specific factors that relate to adherence in this population, for example low levels of social support are linked to older age (Melchiorre et al 2013), and this has been reported as a potential barrier to exercise adherence (Jack et al 2010). These are important considerations because treatment outcomes in this population are associated with compliance to prescribed interventions (Fairhall et al 2016). Picorelli et al (2014) undertook a systematic review of RCTs and cohort studies that assessed adherence to exercise programmes. The average age of participants in these studies was greater than 65 years old. Several factors associated with adherence, relating to the individual, are reported; socioeconomic status and education level, living alone, number of health conditions, self-rated health, number of medications taken, body mass index (BMI), having a pacemaker, better physical function such as gait speed and endurance, depression, loneliness, Mini-Mental Status Examination score, and perceived risk of falling. In addition to these factors relating to the individual, the characteristics of the exercise programmes were also identified as potential factors, with higher rates of adherence seen in the supervised stages of programmes. The limitations of this review include the search being limited to ten years, making it possible that relevant studies could have been excluded. The authors also note that original studies did not necessarily measure variables such as motivation which could impact adherence. The importance of programme design has also been highlighted in a mixed-methods systematic review of adherence to community based group

exercise interventions for older people (Farrance et al 2016). This study reported the importance of various aspects of programme design such as location and ease of access, affordability, structure and content that is relevant to the individual, one to one support, and the content adapted to the individual. The authors also reported additional themes related to adherence including social connectedness, participant perceived benefits, empowering/energising effects and instructor and individual behaviour. It should be noted that this systematic review focused on community based group exercise for older people. Therefore the results may not be generalised to home based individual exercise programmes which will be considered in this thesis.

Hill et al (2011) performed an observational study utilising both quantitative and qualitative methods with 343 participants with an average age of 79.4 years (SD 8.5). The authors collected data via a survey on discharge from hospital and 6 months post discharge. Participants were found to be more likely to engage in exercise if they perceived a serious risk of injury from falling, if exercise was recommended by a physiotherapist, and if they lived with a partner. Variables that were identified as barriers to exercise included low motivation, pain, low self-efficacy, being fearful of exercise, dislike of exercise, and belief that exercise was unnecessary. The study was conducted at a single hospital site and therefore the generalisability of the results may be limited, in addition to the limitation of relying on self-reported adherence to exercise. Forkan et al (2006) undertook a survey of 556 adults 65 years or older after discharge from physiotherapy to explore the factors that effected adherence to exercise. They reported eight barriers that were associated with decreased participation in exercise following discharge. These included having no interest in exercise, health status, bad weather, depression, not having the strength to exercise, fear of falling, shortness of breath, and having a low expectation of outcomes. The study participants had specifically received a programme focusing on balance for those with a history of falls, or near falls, therefore the results may be specifically related to factors such as fear of falling and be less relevant to older adults who do not have impaired balance. In addition to this the study recruited participants from two physical therapy programmes which could again limit generalisability of the results. Resnick and Spellbring (2000) collected quantitative and qualitative data from 23 older adults with an average age of 81 years (SD 7.2 years) 6 months after they had started a walking programme. Data collection was via questionnaires and face to face interviews. They reported that functional limitations due to health, functional performance, self-efficacy, and falls were related to adherence. Their study reported six themes on the subject of exercise adherence and these were; Beliefs about exercise, such as the belief that exercise is a good thing, or the thought that at an older age exercise isn't worthwhile; Specific benefits received from exercise; Past experiences, such as previously exercising a lot, or a little; Goals, which can help with motivation; Personality, specifically determination and laziness; Unpleasant sensations associated with exercise. Participants in this study were recruited from an existing walking group and this may have influenced the results and limited their generalisability to those starting new exercise rehabilitation programmes for MSK conditions. It would not be unreasonable to assume that factors such as motivation may be different for those who are part of an existing exercise group and those who are not.

The studies outlined in the preceding two paragraphs describe a number of factors related to exercise adherence in older people. Whilst it is important to understand the role of these personal factors and programme characteristics, it is also crucial to build on this knowledge and develop interventions for clinicians to enhance adherence to prescribed exercise in older people. This will be

discussed in greater detail later in this thesis when describing the approach to developing the AERO intervention.

2.2.4 Measuring exercise adherence

There is a need to consider how exercise adherence might be measured. When reviewing the literature it is clear that, in the past, different approaches have been described. The most common ways to measure exercise adherence has involved measuring a persons' attempt to undertake the correct dose of exercise, be that the number of exercise sessions completed (Ridgel et al 2016), meeting a pre-defined level of exercise, e.g. walking three times a week, or engaging in aerobic activity ≥3 times a week (Cheetham et al 2004, Yates et al 2005), total minutes spent exercising (Steele et al 2008), or percentage of recommended exercise undertaken (Gallagher 2016).

However, consideration has also been paid to the exercise technique of those performing the exercise programme, for example using the Correctness of Exercise Performance (COEP) scale (Schoo et al 2005).

There are also specific outcome measures that have been designed to measure exercise adherence, such as the Exercise Adherence Rating Scale (EARS) (Newman-Beinart et al 2016) or the Sport Injury Rehabilitation Adherence Scale (SIRAS) (Kolt et al 2007).

Previous systematic reviews have reported that the psychometric properties of outcome measures for exercise adherence are generally poor (Bollen et al 2014), and caution has been advised with the application of such measures (McLean et al 2017). With one review concluding that no criterion standard exists for measuring adherence to home-based rehabilitation (Frost et al 2017). To further compound these difficulties, a recent systematic review attempted to define adherence to therapeutic exercise for MSK pain (Bailey et al 2018), but concluded that there was no specific definition of adherence related to therapeutic exercise for MSK pain.

Differing terminology is used in studies on the topic of adherence. Although the term adherence is commonly used, others such as compliance are seen. The terms compliance and adherence are however considered to be subtly different, with compliance suggesting a patient unquestioningly complies with any treatment advice given, contrasting with adherence which is suggestive of a more equal patient-clinician relationship (Chakrabarti 2014). Given the different terms used in the literature, the author of this thesis will sometimes use a term as it is outlined in an original paper. However, the preferred term for this thesis is adherence in line with the definition given by the WHO *'the extent to which a person's behaviour corresponds with agreed recommendations from a health care provider'* (World Health Organisation 2003). Specifically for this thesis the extent to which a person's exercise behaviour corresponds with agreed recommendations from a physiotherapist.

2.3 Older people

Up to this point the term older people has been used without defining exactly what is meant by an 'older person'. There are no easy answers to the question, how many years old do you have to be to be regarded as old? There are several cut off points to indicate older age used in the literature. These include 60 years old, as used by the United Nations in their World Population Aging 2017 report (United Nations 2017), or 65 years old as used in the UK, by the Office for National Statistics

(Office for National Statistics 2017), or 50 as used by the WHO for their project on a minimum data set for ageing in Africa (World Health Organisation 2002).

One of the challenges in defining older age, or considering the concept of age as a whole, is that it has become more complicated as life expectancy has increased, and at any age people have progressively more years of life remaining (Sanderson and Scherbov 2008). Although there has been a slowing down of life expectancy, in the last 2 to 3 decades life expectancy has increased in the UK, so that in 2016-2018 it was 79.3 years for a male and 82.9 years for a female, compared to 74.49 years for a male and 79.55 for females in 1996-1998 (Office for National Statistics 2019), a trend mirrored globally with an increase in 5.0 years of life expectancy between 2000 and 2015 (World Health Organization 2016). Previously it has been suggested that older age could be considered in relation to life expectancy, and more specifically the number of years of life expectancy remaining. In 1975 Ryder proposed that older age could be considered as beginning when a person's life expectancy dropped below 10 years (Ryder 1975). A similar argument was made by Jacob Siegel in 1993, when he suggested that using 10 or 15 years of remaining life expectancy be considered as the marker of older age (Sanderson and Scherbov 2008). This clearly leaves a number of possible cut off points to categorise 'old age'. In order to determine the best approach for this thesis, consideration was given to the definition or cut off points that have been used in previous literature.

A number of observational and experimental studies in the field of exercise adherence in older people have used 65 years or older as the cut off point (Brassington et al 2002, Forkan et al 2006, Macchi et al 2009, Mailloux et al 2006, Picorelli et al 2014, Stineman et al 2011). In addition to these studies relevant systematic reviews of older people have used inclusion criteria of populations with a mean age of 65 years or greater. Examples of these include Picorelli et al (2014) who published a review which looked at factors associated with adherence to exercise programmes in older people, and Smith et al (2015) who published a systematic review looking at predicting maximal oxygen uptake in older people.

The various possible cut off points outlined above demonstrate the need to define what is meant by older people for this thesis. The decision was taken on the basis of the importance of the work being comparable with literature that has come before. Therefore older age will be defined as 65 years or older.

2.4 Framework for developing an intervention

One of the objectives of this thesis is the development of an intervention to improve exercise adherence in older people that is theoretically underpinned and can be tailored to the individual patient (see section 1.3). To aid the development process an intervention mapping approach (Bartholomew Eldredge et al 2016) was selected. Intervention mapping is a process consisting of six steps that allow for the development of behaviour change interventions. These six steps are 1. Conducting a needs analysis; 2. Creating programme objectives; 3. Choosing relevant theory and considering practical application; 4. Producing and refining the programme components and materials; 5. Considering programme implementation; 6. Developing an evaluation plan. A detailed overview of intervention mapping and justification for the choice of this approach is given in Chapter 5 (see section 5.2.1 and 5.3)

2.5 Summary

MSK conditions are common in older adults affecting life quality. Exercise is a widely used treatment option for MSK conditions. Therefore it would be advantageous to explore ways that make exercise programmes as effective as possible, including attempting to improve adherence to exercise.

3 A systematic review of interventions used to improve exercise adherence in older people, their effectiveness and the behavioural techniques they are based on

3.1 Summary

Exercise is used as the principal treatment option for many MSK conditions experienced by older people. One of the ways to potentially increase the effectiveness of exercise programmes could be to improve adherence to prescribed exercise. There is currently no clear guidance regarding strategies for therapists to optimise adherence to prescribed exercise and no evidence synthesis of exercise adherence for older people. Therefore a systematic review was undertaken to review interventions that have been tested in RCTs. Interventions are reviewed for effectiveness and categorised using a behaviour change taxonomy, in order to understand the behaviour change techniques (BCTs) that they are based upon.

3.2 Introduction

Chapter 2 highlighted that prescribed exercise is a common treatment approach used for MSK conditions experienced by older people but adherence to exercise is poor. Previous literature in the field has focused largely on factors relating to adherence (Essery et al 2016, Jack et al 2010, Palazzo et al 2016, Picorelli et al 2014, Resnick et al 2008, Slovinec D'Angelo et al 2014). It is therefore important to review interventions that could be used to facilitate better adherence to exercise in older people.

Exercise adherence interventions aim to increase the likelihood that people will follow prescribed exercise, in this way they fulfil the definition by The National Institute for Health and Care Excellence (NICE) of a behaviour change intervention being, *'…sets of techniques, used together, which aim to change the health behaviours of individuals, communities or whole populations'* (NICE 2014). Many previous behavioural interventions have been designed utilizing what Martin Eccles calls the ISLAGIATT principle, *'it seemed like a good idea at the time'* (Michie et al 2014). This lack of theoretical underpinning could potentially limit the effectiveness of any interventions. For this reason and so that interventions can be described and categorised, it is important to review the theories or approaches that underpin exercise adherence interventions. One way this can be achieved is through using a method to categorise behavioural approaches, such as the Behaviour Change Technique Taxonomy version 1 (BCTTv1) developed by Michie et al (2013).

A Cochrane review exploring interventions to improve exercise adherence in those aged 18 years and over with chronic MSK pain (Jordan et al 2010) reported that interventions such as self-management techniques and supervised as well as individualised exercise might improve adherence. More recently Peek et al (2016) reviewed adherence to self-management strategies prescribed by physiotherapists. They found that interventions using activity monitoring and feedback systems, written instructions and behavioural exercise programmes with booster sessions may be effective in promoting adherence. Although both these reviews were undertaken on adult populations they did not breakdown the population further and, there remains a need to consider interventions specific to older populations. There have also been disease specific reviews that are relevant to older people, for example in an arthritis population, Ezzat et al (2015) reported limited evidence for exercise

adherence interventions. Nicolson et al (2017) concludes that booster sessions, and behavioural graded exercise can improve adherence for those with OA, in addition to motivational approaches for those with chronic low back pain. However, given that exercise is prescribed for a breadth of conditions, (Hoffmann et al 2016) there is a need to consider a broader, non-disease specific review for older people to draw evidence from a wider population.

Other approaches that have shown potential improvements in adherence include peer delivered programmes and arthritis self-management programmes. Burton et al (2017) reviewed the effectiveness of peers delivering programmes, or motivating older people to increase physical activity and found that involving peers in exercise programmes can promote adherence. Williamson et al (2015) reviewed behavioural physical activity interventions in those with lower limb OA. They reported that self-management programmes in this population demonstrate a small but significant improvement in short-term physical activity. Although both these examples focus on physical activity, rather than exercise, there may be some cross over, and there remains a need to review interventions in the field of therapeutic exercise. Whilst we know there is no clear guidance regarding approaches for therapists to optimise adherence to prescribed exercise, there are studies that consider older patients and adherence (Schneider et al 2011, Schoo et al 2005, Wu et al 2010), but no evidence synthesis as yet. Therefore the aim of this review is threefold, to:

- Establish what interventions have been described in the literature to improve adherence to prescribed exercise in older people
- Determine to what extent these interventions are effective at improving exercise adherence
- Describe any underlying behavioural techniques or theory behind these interventions

3.3 Methods

The design and conduct of this systematic review has been undertaken with consideration of the Preferred Reporting Items for Systematic reviews and Meta-analysis (PRISMA) (Liberati et al 2009, Moher et al 2009). This review has been registered with The International Prospective Register of Systematic Reviews (PROSPERO), registration number CRD42015020884 available at http://www.crd.york.ac.uk/PROSPERO

3.3.1 Data sources

The following electronic databases were searched from inception up to May 2017 AMED, BNI, CINAHL, EMBASE, Medline and PsycINFO. Reference lists of all included studies were also screened. An updated search was run prior to completion of this thesis in March 2020 on the same databases, to give an overview of studies published since the initial systematic review was completed. This updated search is reported in section 3.4.4.

3.3.2 Search terms

Initial search terms were developed by JR. These were expanded at two consensus meetings attended by health care researchers and also reviewed by a healthcare librarian and further changes made. Both subject headings and free text search terms are used. Figure 3.1 gives an example of the terms used for Medline Medical Subject Headings (MeSH). The terms are highlighted in bold.

Figure 3.1 Search terms, example from the Medline database

1. **Medline; exp AGED/;**
2. Medline; older.ti,ab;.
3. Medline; (Older AND NEAR AND Adult).ti,ab;
4. Medline; elderly.ti,ab;
5. Medline; adherence.ti,ab;
6. **Medline; exp PATIENT COMPLIANCE/;**
7. **Medline; exp PATIENT PARTICIPATION/;**
8. Medline; attendance.ti,ab;
9. Medline; ((Change OR changes OR Changing) AND NEAR AND (Behaviour OR Behavior)).ti,ab;
10. Medline; ((Modify OR Modifies OR Modifying) AND NEAR AND (Behaviour OR Behavior)).ti,ab;
11. Medline; adhering.ti,ab;
12. Medline; complying.ti,ab;
13. Medline; exp MOTIVATION/;
14. Medline; concordance.ti,ab;
15. Medline; co-operation.ti,ab;
16. Medline; engagement.ti,ab;
17. **Medline; exp EXERCISE/;**
18. **Medline; exp REHABILITATION/;**
19. Medline; (older ADJ5 patient*)
20. Medline; 1 OR 2 OR 3 OR 4 OR 19;
21. Medline; 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16;
22. Medline; 17 OR 18;
23. Medline; 20 AND 21 AND 22;

3.3.3 Study selection

The databases outlined above were searched by JR, titles and abstracts of returned studies were screened and if potentially relevant full texts were retrieved. A second reviewer, EH, independently searched the Embase database. This database returned 1,179 studies, 20.55% of all studies returned. Results were compared by JR and EH, and where there was disagreement this was resolved by discussion. If agreement could not be reached a third reviewer KB was available. Full texts were reviewed independently by JR and EH against the inclusion criteria. After full texts were reviewed results were compared. If there was disagreement this was resolved by discussion, if needed KB was available where agreement could not be reached.

3.3.4 Eligibility criteria

Studies had to meet the following inclusion criteria.

- Including a population that had a mean age of 65 years or older; to ensure the papers included investigated exercise adherence in an older population which was the focus of this study and thesis.
- Including a population that was community dwelling; reviewing the evidence for an institutionally dwelling population should be a separate review in its own right and was beyond the scope of this review.

- RCT design; to allow an exploration of the effectiveness of the intervention which would not be possible with other study designs such as cohort studies.
- Including interventions aimed at improving adherence to exercise, compared to either no adherence intervention; another adherence intervention; or an intervention which does not aim to improve adherence; to fulfil the aims of the review and establish what interventions have been described in the area.
- A comparator group which was also undertaking the exercise programme. Where a no intervention control group occurred, there needed to be a least two active intervention groups to offer a comparison; a comparison group was needed to determine effectiveness.
- Published in English; the resources available for the project meant that it was not possible to translate works published in languages other than English.
- Peer reviewed; to ensure that studies had been robust enough to have gone through review and publication.

Studies were excluded for the following reasons.

- Studies including a population with a diagnosis of dementia or cognitive impairment; dementia and cognitive impairment are significant areas that could be a topic in their own right and were beyond the scope of this review.
- Any study design that was not a RCT; other study designs would not be able to assess effectiveness.
- Study design that was a protocol, feasibility or pilot study including pilot RCTs; the aim of pilot or feasibility studies is not to test effectiveness and they were therefore excluded.

3.3.5 Data extraction

Data were extracted from included studies by two reviewers, JR and EH, who independently used standardised pre-prepared forms (appendix 1). Data were extracted based on the domains of study design, participants, setting, type and dose of intervention, underlying theory, the comparator arm, the method of assessment, outcome measures used and study findings.

3.3.6 Risk of Bias

Risk of bias was assessed independently by two reviewers, JR and EH. One reviewer remained blinded to author, journal, publication date and affiliations. The Cochrane Collaboration's tool for assessing risk of bias was used (Higgins and Altman 2008). Studies were reviewed for the following domains: sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessors, incomplete data, selective outcome reporting and other sources of bias. Each domain was graded as low risk of bias, high risk of bias or uncertain risk.

For sequence generation, low risk of bias was assigned if an appropriate method of random allocation to groups was used, to permit for comparable groups at baseline. High risk was assigned if a non-random method was used, and/or at baseline groups were significantly different in any relevant characteristics. Uncertain risk was assigned if the description given was not clear.

For allocation concealment, low risk was assigned if a method of concealment, such as opaque sealed envelopes was described. High risk was assigned for any method which allowed participants or investigators to predict allocation. Uncertain risk was assigned where the description was not clear.

For blinding of participants and personnel, low risk was assigned where, if possible, studies reported blinding of participants and personnel. High risk was assigned if it was possible to blind, but this was not done. Uncertain risk was assigned if the author acknowledged that blinding personnel or participants in exercise or rehabilitation studies was very difficult or was not possible.

For blinding of outcome assessors, low risk was assigned where a specific description of action to blind outcome assessors, or those handling data for outcomes that were self-reported questionnaires completed at home, was given. High risk was assigned if assessors were not blinded. Uncertain risk was assigned where it was unclear.

For incomplete data, low risk was assigned if there was a description of appropriate measures to deal with missing data, or there was little or no incomplete data. High risk was assigned where there was a large amount of missing data, or no description of action to manage missing data. Uncertain risk was assigned where it was unclear.

For selective outcome reporting, low risk was assigned if a study protocol was available and where all outcomes described were reported. High risk was assigned if not all outcomes were described. Uncertain risk was assigned if no study protocol was available.

For other sources of bias, low risk was assigned if it was felt that there were no other sources of bias that could affect the results. High risk was assigned if there were other potential sources of bias, for example small sample size. Uncertain risk was assigned if this was unclear.

If disagreement between reviewers occurred this was resolved through discussion. If consensus could not be met, then a third reviewer, KB was available. If required, authors were contacted to gather further information.

3.3.7 Data synthesis

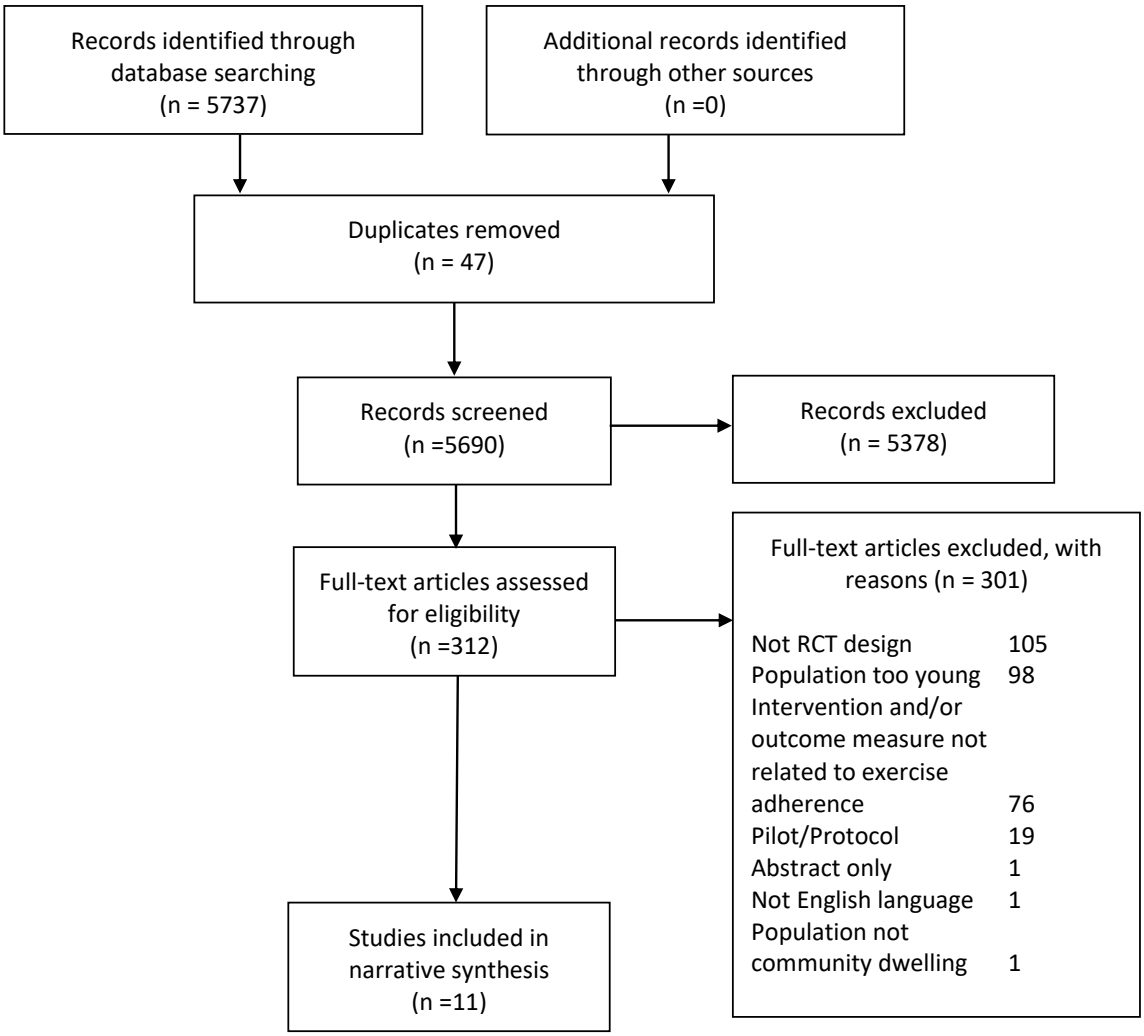
Performing a statistical meta-analysis was not possible due to the heterogeneous nature of the interventions and the different outcomes used for measuring adherence to exercise. Therefore the results are presented narratively and the interventions are classified according to the BCTs they employed, as described in the pre-defined BCTTv1 (Michie et al 2013). This taxonomy categorises BCTs by the active ingredients they utilise. The taxonomy consists of 93 individual BCTs organised into 16 separate categories (appendix 2), examples of the categories are ‘Goals and planning’ and ‘Feedback and monitoring’. As part of the development of this taxonomy a definition for each BCT is given and these are available on the research project’s website, or via the BCTTv1 smart phone app. Study interventions were reviewed and compared against the definitions used to define each BCT. This meant that the interventions from papers included in the review were categorised into 1 of the 16 categories from the BCT1. For this thesis the categorisation of interventions using the method above was first undertaken by the author then reviewed by a second researcher. Each study is also

presented in table 3.1 so that the effectiveness of each intervention can be viewed independently. Group mean or median scores and 95% confidence intervals (CI) are presented. On some occasions there was not enough data in the original studies to calculate a 95% CI, where this occurs means scores alone are presented. P-values are presented to indicate statistical significance between group means. A p-value represents the chance of finding a result at least as large as the one reported in the study, if there was actually no real effect (Colquhoun 2017). Therefore the p-value can tell us of the chance that an effect might be present, it doesn't, however say anything about the size of that effect. For this an effect size is required (Sullivan and Fienn 2012) and where possible they have been calculated using either Cohen's d or Pearson's r (see section 6.3.8) based on group differences at the longest follow up time point available. For some studies, data was not available to calculate an effect size and this is indicated in table 3.1. Where this is the case an absolute effect size can be inferred by observing the difference in mean scores (Sullivan and Fienn 2012).

3.4 Results

The results are summarised in table 3.1. Through database searches, 5737 papers were identified with 47 duplicates removed, leaving 5690 records to screen. After screening 5378 records were excluded. For the remaining 312 papers the full text was retrieved. At this stage 301 studies were removed as they did not meet the inclusion criteria, leaving 11 studies which were included in the final review (Boshuizen et al 2005, Cheetham et al 2004, Duncan and Pozehl 2003, Gallagher 2016, Gardner et al 2011, Ridgel et al 2016, Schneider et al 2011, Schoo et al 2005, Steele et al 2008, Wu et al 2010, Yates et al 2005). A flow chart of this process can be seen in figure 3.2

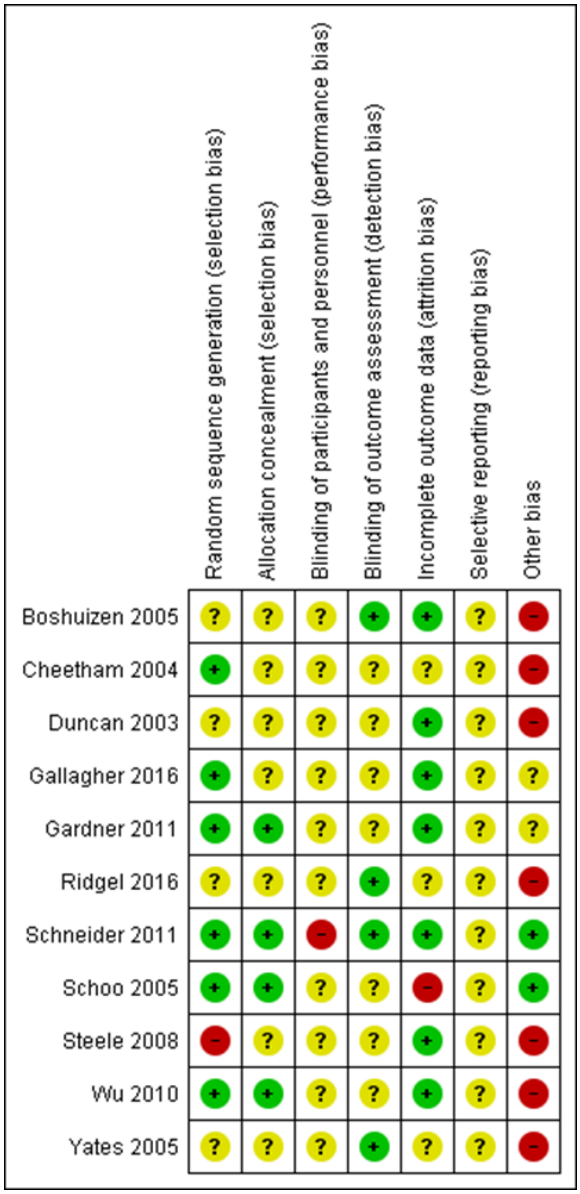
Figure 3.2 PRISMA flow diagram for the systematic review



3.4.1 Risk of bias

The included studies were assessed using the Cochrane Collaboration's tool for assessing risk of bias. No studies were rated as low risk of bias, two studies were rated as moderate risk of bias and nine studies as high risk of bias. The scores for each domain can be seen in figure 3.3. The common areas where risk of bias was observed was in the relatively small sample sizes, and the lack of sample size justification of most studies.

Figure 3.3 Risk of bias assessment using the Cochrane Collaboration's tool for assessing risk of bias



3.4.2 Types of intervention

Several different interventions were identified, these are categorized according to the BCTTv1 developed by Michie et al (2013). A full description of the studies is given in table 3.1. The interventions identified are described narratively in section 3.4.2.1 under the headings of the BCCTv1 categories in which they were placed. A full list of these categories can be seen in appendix 2.

Table 3.1 Study Characteristics

Author	Population	Adherence Intervention	Behavioural theory	Measure of adherence	Control or comparison	Results	Conclusion
Boshuizen et al 2005	Frail elderly **Mean age - years** High guidance 80.0 (SD 6.7), dropouts 80.8 (SD 5.3) Medium guidance 79.3 (SD 7.0), dropouts 79.9 (SD 5.9), Control 77.2 (SD 6.5), dropouts 75.2 (SD 10.5) **Gender** Male = 5.6%	Guidance and supervision 1) 2 supervised sessions and 1 unsupervised a week 2) 1 supervised session and 2 unsupervised session a week	None given	Percentage of exercise sessions (supervised + unsupervised), taken from physical therapists' records and self-report diaries. At each location different physical therapists collected outcomes from those that lead the training	Asked to remain habitually active	Percentage of exercise sessions undertaken High guidance 79 (range 57-100) Medium guidance 72 (range 20-93) (No significant difference between groups) Effect size – Not possible to calculate	No significant difference in the number of exercise sessions completed between the groups
Cheetham et al 2004	Intermittent claudication **Mean age** - 67 years	Weekly exercise and motivation class	None given	Self-reported compliance at 6 months – asked whether they	Exercise advice – verbal and written	Average frequency of 30 min walks to near pain undertaken Supervised exercise <3 times 2	A larger number of people in the exercise class group reported to be walking either 3 times a week or >3

	Gender Male = 67%			walked <3 times, 3 times or >3 times a week. Data compiled by blinded personnel		3 times 8 >3 times 19 Advice <3 times 9 3 times 11 >3 times 9 r=0.31	times a week (p=0.012)
Duncan and Pozehl 2003	Heart failure **Mean age** - 66.4 years **Gender** Male = 87.5%	Individualized graphic feedback on exercise goals, participation and problem solving	Social learning theory	Exercise diaries – number of sessions completed	Exercise programme without adherence intervention	Exercise sessions completed 12 weeks Control 59.3 (SD 11.1, 95% CI 51.1 to 67.5) Intervention 62.3 (SD 6.4, 95% CI 57.9 to 66.7) 24 weeks Control 41.2 (SD 9.7, 95% CI 34 to 48.4) Intervention 59.6 (SD 10.6, 95% CI 51.8 to 67.5)* *significant difference (p<0.01) Effect size d=1.81	The adherence intervention can increase exercise sessions completed after finishing a supervised exercise programme in patients with heart failure.

Gallagher 2015	Physical therapy patients with low back, hip or knee symptoms **Mean age** - years 69.3 (SD 6.87) **Gender** Male = 28.3%	Printed messages and magnets underpinned by socioemotional selectivity theory 1) Emotional and meaningful message 2) Factual and information message	Socioemotional Selectivity theory	Self-reported adherence to their exercise program (used to calculated adherence score)	One message group compared to the other	Average adherence score % Emotional 60% (SD 34.4%, 95% CI 47.3 to 72.7) Factual 55.3% (SD 34.0%, 95% CI 43.5 to 67.1) (No significant difference between groups) Effect size d=0.137	No significant difference found in participants' adherence between the message groups
Gardner et al 2011	Intermittent claudication **Mean age** - years Control 65 (SD 10) Supervised 66 (SD 12) Home 65 (SD 11) **Gender** Male = 47.9%	Supervised vs unsupervised exercise 1) Home Exercise (no supervision) for 12 weeks + step activity monitor 2) Supervised exercise for 12 weeks + step activity monitor	None given	Total exercise sessions, using step activity monitor and exercise log book	Encouraged to walk more on their own	Total exercise sessions completed % Supervised group 84.8 (SD 20.9, 95% CI 77.7 to 91.9) Home group 82.5 (SD 27.7, 95% CI 72.4 to 92.6) (No significant difference between groups) Effect size	The relatively high adherence rate in home-based exercise was similar to that found with supervised exercise group

						d=0.094	
Ridgel et al 2016	Parkinson's disease and depression **Mean age** – years 70.2 (SD 7.9) **Gender** Male = 63.3%	Psychoeducation, peer education/support, group exercise (EXCEED group)	None given	Number of exercise sessions attended, recorded by a research assistant. Those collecting outcome measures were blinded to group assignment	Self-guided psychoeducation and exercise (SGE). No group interactions or peer education	Number of exercise sessions attended at 12 weeks EXCEED = 20.7 (SD 8.1, 95% CI 16.6 to 24.8) SGE = 22.0 (SD 8.0, 95% CI 17.9 to 26.1) Effect size d=0.161	Both groups attended a similar number of exercise sessions.
Schneider et al 2011	Older adults who engage in aerobic or strengthening exercise less than 3 or more days a week **Mean age** - years 71.8 (SD 5.1) **Gender** Male = 24.1%	Cognitive Behavioral Therapy 1) CBT group 2) Attention-control education group	Cognitive Behavioral Therapy	Time spent exercising in the past month. Exercise behaviour was assessed by a research assistant blinded to group allocation	No CBT, No attention control education group	Time spent exercising (h/week) 3 months CBT = 1.0 (SD 0.8, 95% CI 0.852 to 1.15) Education = 1.1 (SD 0.8, 95% CI 0.951 to 1.25) Control = 1.3 (SD 1.3, 95% CI 1.06 to 1.54) 6 months CBT= 1.0 (SD 0.7, 95% CI 0.871 to 1.13)	No significant difference with time spent exercising between groups.

					Education = 1.0 (SD 0.7, 95% CI 0.869 to 1.13) Control = 1.2 (SD 1.3, 95% CI 0.956 to 1.44) 9 months CBT = 1.0 (SD 1.2, 95% CI 0.779 to 1.22) Education = 1.2 (SD 2.3, 95% CI 0.77 to 1.63) Control = 1.0 (SD 1.0, 95% CI 0.812 to 1.19) 12 months CBT = 0.9 (SD 1.0, 95% CI 0.716 to 1.08) Education = 1.2 (SD 2.4, 95% CI 0.752 to 1.65) Control = 1.1 (SD 1.1, 95% CI 0.893 to 1.31) (No significant difference between groups) Effect size CBT v education d=0.163 CBT v Control d=0.190

						Education v control d=0.05	
Schoo et al 2005	Osteoarthritis of the hip and/or knee **Mean age – Years** Brochure - 71.1 (SD 6.83) Audio - 70.9 (SD 7.23) Video - 69.2 (SD 6.36) **Gender** Male = 33%	Exercise program instruction method:- 1) Brochure + audio tape 2) Brochure + video tape	None given	Home exercise log-sheets	Brochure only group	Home exercise adherence (median) 1-4 weeks:-Brochure 93% Video 92% Audio 89% 5-8 weeks:- Brochure 89.5% Video 81.5% Audio 87% (No significant differences) Effect size – Not possible to calculate	Audio and video tapes given in addition to an exercise brochure, did not show an increase in adherence compared to the brochure only group.
Steele et al 2008	Chronic lung disease **Mean age** - 67 years **Gender** Male = 92.5%	Weekly phone calls and 1 home visit over 3 months Consisting of dealing with queries about exercise adherence, problem solving, exercise maintenance, recommendations about health problems, encouragement, evaluated home	None given	Exercise diary – total minutes of exercise	Continued care from referring provider. Recommendation for continuation of the exercise program. Invited to attend the lung club group sessions.	Minutes of exercise Pre-intervention Control 14 (SD 14, 95% CI 22.6 to 33.5) Intervention 21 (SD 19, 95% CI 15.9 to 26.1)* Post-intervention Control 28 (SD 21, 95% CI 22.6 to 33.5)	The adherence intervention gave limited improvement in the short-term regarding self-reported maintenance of exercise after pulmonary rehabilitation in highly sedentary chronic lung disease patients. No long term benefit was found.

		safety, assistance in establishing an individualized exercise routine. Receiving a digital pedometer and exercise handbook.				Intervention 30 (SD 32, 95% CI 21.5 to 38.5) 20 weeks Control 16 (SD 19, 95% CI 10.8 to 21.2) Intervention 32 (SD 46, 95% CI 19.2 to 44.8)* 1 year Control 22 (SD 25, 95% CI 14.8 to 29.1) Intervention 33 (SD 36, 95% CI 22.1 to 43.9) *significant differences (p<0.05) Effect size d=0.398	
Wu et al 2010	People at risk of falling **Mean age** - years Telecommunication 76.1 (SD 7.9) Community 74.1(SD 6.9) Home 75.9 (SD 6.3)	Method of delivering exercise program:- 1) Instructor lead video call at home 2) Instructor lead community-based group	None given	Log sheets -Number of sessions -Time exercising	Home exercise with DVD	Total time exercising (h) Video call 30 (SD 12, 95% CI 25 to 35) Community 31 (SD 12, 95% CI 25.7 to 36.3)	Compared to home-exercise, video conferencing and community classes were better for total time spent exercising and number of exercise sessions completed.

	Gender Male = 15.6%			Home 17 (SD 17, 95% CI 9.9 to 24.1) Attendance rate (%) Video call 69 (SD 27, 95% CI 57.7 to 80.3) Community 72 (SD 27, 95% CI 60.2 to 83.8) Home 38 (SD 46, 95% CI 18.8 to 57.2) (video call and community significantly higher for time exercising and attendance rate (both $p<0.01$) Effect size Video call v community d=0.083 Video call v Control d=0.884 Community v Control d=0.951

Yates et al 2005	Post cardiac rehabilitation **Mean age** – years 66.7 (SD 9.4) **Gender** Male = 69%	Booster sessions, structured education and counselling given - 1) Over the phone 2) In clinic	Self-Efficacy Theory	Considered adherent if they had performed exercise ≥ 3 x a week	Usual care 1 telephone call at 4-6 weeks	Adherence rate at 3 months Control 50% Clinic 70% Phone 75% Adherence rate at 6 months Control 50% Clinic 40% Phone 63% (No significant difference we found between groups) Effect size – Not possible to calculate	Adherence to the recommended exercise program was greater in the two treatment groups compared to usual care at 3 months, but differences were not significant.

*Effect sizes are given for the longest follow up time period

3.4.2.1 Interventions categorised by BCTTv1 categories

Feedback and monitoring

A study with a high risk of bias (Cheetham et al 2004), compared weekly exercise and motivation classes for a 6 month period against verbal and written exercise advice in participants with intermittent claudication. Subjects were asked to walk to near maximal pain at least three times a week. At 6 months follow up, 27 out of 29 in the intervention group reported walking either 3 times a week, or more than 3 times a week, compared to the advice group where 18 out of 29 reported walking 3 or more times a week (r=0.31, p<0.012).

Another study with a high risk of bias (Duncan and Pozehl 2003), supplied individual graphic feedback related to exercise goals for participants with heart failure. At 24 weeks there was a significant difference in the number of exercise sessions completed between the intervention group and a control group. The intervention group mean number of sessions was 59.6 (95% CI 51.8 to 67.5) and the control group mean number of sessions 41.2 (95% CI 34 to 48.4) (d=1.81, p<0.01).

A further study with a high risk of bias (Wu et al 2010), studied participants adherence to a Tai Chi exercise programme for those at risk of falling that was either delivered as a class in a community centre, or via an interactive telecommunication approach, compared to a control group consisting of home based exercise with a DVD. The authors found that the community-based and telecommunication groups had significantly higher results for attendance rate and for time exercising compared to the home-based exercise group (p<0.01. Total exercise time in hours; Interactive telecommunication 30 (95% CI 25 to 35), Community 31 (95% CI 25.7 to 36.3), Home 17 (95% CI 9.9 to 24.1), Interactive telecommunication v Community d=0.083, Interactive telecommunication v Home d=0.884, Community v Home d=0.951).

Social support

One study with a high risk of bias (Boshuizen et al 2005) examined guidance and supervision for frail elderly participants, they compared a high guidance and median guidance group. The authors found no significant difference between the groups when comparing the percentage of exercise sessions completed, with the high guidance group recording a mean of 79% completed (range 57-100) and the medium guidance group 72% completed (range 20-93).A second study with a high risk of bias (Ridgel et al 2016) compared self-guided psychoeducation and exercise, with psychoeducation, peer support and group exercise in those with Parkinson's disease. At 12 weeks the groups attended a similar number of exercise sessions. The self-guidance group attended 22.0 sessions (95% CI 17.9 to 26.1), the peer support group 20.7 sessions (95% CI 16.6 to 24.8), d=0.161).

A third study with a high risk of bias (Steele et al 2008), assessed an adherence intervention for those with chronic lung disease compared against a control. The intervention consisted of weekly phone calls and a single home visit in a three month period. During the phone calls participants were offered help with queries about exercise adherence and maintenance, problem solving, discussion and recommendations about health problems and encouragement. The home visits evaluated home safety and helped with establishing an exercise routine. At 20 weeks there was a significant difference in minutes of exercise undertaken. The control group undertook 16 minutes (95% CI 10.8 to 21.2), the intervention group 32 minutes (95% CI 19.2 to 44.8), (d=0.455 p<0.05). However this

significant difference was not found at 1 year (control 22 minutes (95% CI 14.8 to 29.1), intervention 33 minutes (95% CI 22.1 to 43.9), (d=0.398 *p*>0.05).A study with a moderate risk of bias (Gardner et al 2011) compared home-based exercise with no supervision with supervised exercise. No significant difference was found between groups for total exercise sessions completed. The supervised group undertook 84.8 sessions (95% CI 77.7 to 91.9) and the home group 82.5 sessions (95% CI 72.4 to 92.6), (d=0.094, *p*=0.712).

Natural consequences

A study with a moderate risk of bias (Gallagher 2016), gave older adults one of two different adherence messages based on Socioemotional Selectivity Theory (Carstensen et al 1999). The first message type highlighted emotionally meaning reasons to exercise, such as spending time with loved ones and the second message type emphasised knowledge related goals, such as stronger muscles. Two weeks after discharge from physical therapy, no significant difference was found in average adherence scores between groups. The emotional group had 60% adherence (95% CI 47.3 to 72.7), the factual group 55.3% adherence (95% CI 43.5 to 67.1), (d=0.137, *p*=0.03).

Comparison of behaviour

A single study with a high risk of bias (Schoo et al 2005) compared exercise instruction given in audio format or video format in addition to written instructions, against a control who received only written instructions. They found no significant difference in mean adherence to exercise between the groups at 1-4 weeks. The adherence for the written instruction group was 93%, video group 92%, audio group 89%, *p*=0.690 and at 5-8 weeks written instruction group was 89.5%, video group 81.5%, audio group 87%, *p*=0.538.

Identity

A study with a high risk of bias (Schneider et al 2011) reviewed older adults exercise behaviour after being allocated to one of three groups, cognitive behavioural therapy (CBT) where participants were taught to identify and adjust their thoughts in relation to exercise, an attention control education group which consisted of participants receiving health related information in a way which was not personalised to the lives of the participants, or a control group. At 3, 6, 9 and 12 months follow up no significant difference was found in time spent exercising. At the 12 month follow up CBT = 0.9 hours per week (95% CI 0.716 to 1.08), education = 1.2 hours per week (95% CI 0.752 to 1.65), control = 1.1 hours per week (95% CI 0.893 to 1.31), (CBT v education d=0.163, CBT v control d=0.190, education v control d=0.05).

Goals and planning

One study with a high risk of bias (Yates et al 2005), compared an over the phone, or face to face educational counselling booster session versus usual care, which consisted of one telephone call to discuss programme satisfaction and cardiovascular risk reduction behaviours with minimal counselling offered, for those who had previously undergone cardiac rehabilitation . Booster sessions used participants' individual goals as the basis for the intervention. Participants were praised if they were progressing towards their goals, and additionally encouraged to ascribe their success to their own ability. If needed, a discussion of barriers standing in the way of goal achievement took place. At 3 and 6 months no significant difference in adherence rates were found

between groups. At 3 months the control group had 50% adherence, face to face 70%, phone 75%, and at 6 months, control 50%, face to face 40%, phone 63%.

3.4.2.2 Behavioural theories

Behavioural theories were used in four studies to justify their chosen intervention. Duncan and Pozehl (2003) used individual graphic feedback related to exercise goals, this was underpinned by Social Learning Theory (Bandura 1971) which proposed that people learn by observing others, their behaviours and the outcome of those behaviours.

Gallagher (2016) used two different types of adherence messages, either with an emphasis on emotional meaning, or on knowledge related goals. This intervention was based on Socioemotional Selectivity theory (Carstensen et al 1999), which suggests that time effects the pursuit of goals, with social motives being either more related to the acquisition of knowledge, or more related to emotional regulation. If time is felt to be limited, emotional goals assume more importance.

Schneider et al (2011) used a CBT intervention. CBT is based on the premise that thoughts, emotions, feelings, situations and actions are connected, it therefore aims to help participants break negative thought cycles (NHS Choices 2016).

Yates et al (2005) reported an intervention that used face to face or over the phone booster sessions. The intervention was informed by Bandura's self-efficacy (Bandura 1977). Self-efficacy refers to an individual's belief in their capability to perform an activity and achieve a desired goal.

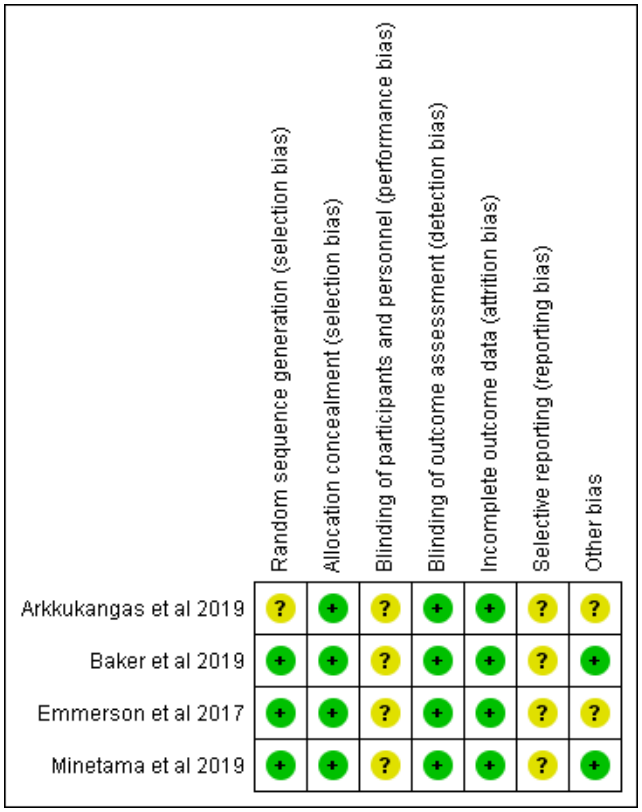
The theories outlined above are reported in the original papers or described in previously published work. Although the theories seem to be relatively well embedded within the work described it is not possible to know the extent to which the interventions were actually based on the described theories.

Seven of the included studies did not describe any behavioural theory. Of the studies which reported an underlying theory, one found a significant improvement in exercise adherence (Duncan and Pozehl 2003).

3.4.3 Review update

An updated search was run prior to the completion of this thesis. It revealed an additional four studies published between May 2017 and March 2020. A summary of the risk of bias for these studies is shown in figure 3.4 with an overview below it.

Figure 3.4 Risk of bias assessment using the Cochrane Collaboration's tool for assessing risk of bias for the 4 additional studies



A study with a moderate risk of bias (Arkkukangas et al 2019) compared a falls prevention exercise programme with or without the addition of motivational interviewing. They reported that at 12 week follow up there were no significant differences in adherence between the groups with both groups recording a mean score of 42% of participants adhering to exercise 3 times a week.

A second study with a moderate risk of bias (Baker et al 2019) tested a computer-based telephone counselling intervention on long-term adherence to a strengthening programme for older people with knee OA. They found no significant difference in self-rated adherence, using a scale 0-10 where 10 represented completely adherent, between the groups at 24 months. The control mean score was 4.01 (95% CI 3.03 to 4.99), intervention mean score 3.63 (95% CI 3.63 to 4.56), (d=0.12, *p*=0.57).

A third study with a moderate risk of bias (Emmerson et al 2017) compared adherence to a home exercise programme supported by exercise videos with reminders against exercise programmes written on paper, for those post stroke. After 4 weeks of exercising the authors reported no significant difference in adherence between the groups with the intervention mean 62% of exercises completed (SD 25), the control mean 60% of exercises completed (SD 28), difference 2 (95% CI -12 to 17, (d=0.08, *p*=0.785).

A fourth study with a moderate risk of bias (Minetama et al 2019) conducted a trial comparing supervised physiotherapy and unsupervised home exercise, both groups were asked to undertake a daily walk and perform a home exercise programme. Participants' adherence to their exercise

programme was measured with self-report diaries and a pedometer measured daily step count. At 6 weeks the self-reported number of sessions was not significantly different between the groups, with the supervised group reporting a mean of 1.9 sessions per day and the unsupervised group a mean of 1.7 sessions per day (p=0.38), although the difference in daily steps was significantly higher in the supervised group, with more participants in this group achieving the minimum clinically important difference (51.2% v 25.6%, between group difference 25.6% (95% CI 4.9% to 43.9%, p=0.01).

Only two of the studies reported a theoretical underpinning to their intervention. These were Arkkukangas et al (2019) who used motivational interviewing (Rollnick and Miller 1995), and Baker et al (2019) whose intervention was based on self-efficacy (Bandura 1977), Social Cognitive Theory (Bandura 1989), and the transtheoretical model (Prochaska and Velicer 1997).

3.4.4 Hierarchy of evidence based on risk of bias

All studies from both the initial search and updated search are outlined in table 3.2 in order to show a hierarchy based on the level of risk of bias. Studies are grouped based on their risk of bias. It is also indicated if the study reported an improvement in exercise adherence with their intervention.

Table 3.2 – Studies outlined by risk of bias level

Risk of bias	Author	Significant improvement in exercise adherence reported
Moderate	Arkkukangas et al 2019	No
	Baker et al 2019	No
	Emmerson et al 2017	No
	Gardner et al 2014	No
	Gallagher 2016	No
	Minetama et al 2019	No
High	Boshuizen et al 2005	No
	Cheetham et al 2004	Yes
	Duncan and Pozehl 2003	Yes
	Ridgel et al 2016	No
	Schneider et al 2011	No
	School et al 2005	No
	Steele et al 2008	Yes
	Wu et al 2010	Yes
	Yates et al 2005	No

3.5 Discussion

This systematic review was undertaken to explore exercise adherence interventions tested in RCTs in older adults. Interventions were categorized using the BCTTv1 (Michie et al 2013). Each of the interventions grouped in the feedback and monitoring category found positive results for adherence to exercise, although generalisability of these results are limited by risk of bias. The inconclusive results are in line with similar reported results to adherence promoting interventions in different populations. Peek et al (2016) reviewed interventions that supported adherence to prescribed self-management strategies in physiotherapy, finding that some interventions demonstrated a positive effect on adherence, however their clinical use could not be recommended due to insufficient data. A further review by McLean et al (2010) studied interventions that aimed to enhance adherence to MSK physiotherapy treatment. They found moderate evidence that a motivational cognitive behavioural programme is effective at improving exercise based clinic session attendance, however conflicting evidence was found for adherence approaches to enhance short-term exercise adherence, and strong evidence was found that adherence interventions were not effective for improving long term adherence to exercise. There have however been positive results reported for exercise adherence interventions relevant to older people in disease specific populations, such as OA and rheumatoid arthritis (RA) (Ezzat et al 2015). These interventions have included graded activity programmes, goal orientated consultations and motivational counselling showing positive results, or for back pain and hip and knee OA (Nicolson et al 2017), with booster sessions, behavioural graded activity and motivational programmes targeting self-efficacy which have also shown positive results.

This systematic review gives a synthesis of evidence specifically for older populations, without limiting it to a specific condition. Four studies found positive results. Three of these studies included interventions that were grouped in the feedback and monitoring category namely, exercise delivered in a community class setting, or via tele-communication (Wu et al 2010), supervised exercise and motivation classes (Cheetham et al 2004) and individualised graphic feedback (Duncan and Pozehl 2003). In each of these studies the method of feedback or monitoring was different, yet they all produced positive results, but the overall generalisability is reduced due to risk of bias. However, there could be scope for further study in this area. It is possible that feedback and monitoring may help to overcome some of the barriers faced by older people when trying to adhere to exercise, for example low self-efficacy and motivation (Hill et al 2011). In addition, feedback and monitoring may help to facilitate adherence to exercise as programmes with supervision generally demonstrate better adherence (Picorelli et al 2014). Peek et al (2016) also reported that feedback systems and monitoring activity could help facilitate adherence.

This mirrors evidence found in other populations (Polonsky and Fisher 2015, Shakudo et al 2011), where it has been suggested that feedback could improve adherence to exercise programmes for those with borderline hypertension (Shakudo et al 2011). Feedback is additionally used in promoting self-care for people with diabetes (Polonsky and Fisher 2015). A potential common factor with these kinds of interventions is the number of contacts with healthcare professionals, which is greater when compared to control groups. This is consistent with work done in other areas where the number of contacts can affect behaviour change, for example with exercise advice to treat young adults with prehypertension and hypertension (Williamson et al 2016).

Prescribed exercise is a common treatment approach which is likely to be further utilised in the future as the population lives longer (Suzman and Beard 2011) with more LTCs (Department of Health 2012). Therefore approaches to facilitate adherence should remain an important factor for those who prescribe exercise. A potential area where exercise adherence research could progress would be to consider the theories that underpin these interventions. Measuring adherence to exercise is fundamentally measuring behaviour change, i.e. the person's behaviour change corresponds to a recommendation from a health care provider (World Health Organisation 2003), in this case adhering to an exercise programme. It is of interest that seven of the included studies from the initial search, and a further two from the updated search did not describe any behavioural theory which may have potentially limited the effectiveness of the interventions. One important aspect in developing complex interventions, as described by the Medical Research Council (MRC) guidance, is use of the best available evidence and appropriate theory (Craig, Dieppe, Macintyre, Mitchie, et al 2008). If exercise adherence interventions have a lack of theoretical underpinning, this may affect the chances of successfully changing the behaviour of study participants. It may also limit the ability to categorise and replicate these interventions.

Where behavioural theory is used, there may also be room for further consideration. Michie et al (2011) produced The Behaviour Change Wheel (BCW) as a framework for behaviour change interventions. At the centre of the BCW is the COM-B model that proposes that there are three essential components to behaviour change, these are capability, opportunity and motivation. Interventions might need to target one, two or even all three components to bring about change. Strategies targeting only one of these domains may not see the desired change in behaviour, for example, giving participants information may target the capability domain but have no effect on the opportunity or motivation components. Appropriately developed interventions based on relevant theory, are likely to maximise the potential for changing behaviour, in this example adherence to prescribed exercise.

One particular challenge to researching exercise adherence is how to measure adherence itself. Previous research has reported that although numerous methods for reporting adherence to exercise exist, on the whole there is a lack of valid and reliable outcome measures (Bollen et al 2014). This is reflected in the results of this review that demonstrate a diverse range of outcome measures for adherence. The availability of robust outcome measures would help by increasing confidence in the effects of interventions and making comparison of interventions and meta-analysis an easier process. Another important consideration is that of contextual equivalence of the intervention and control groups. Bishop et al (2015) studied the contextual effects and BCTs of control and active interventions from studies within a Cochrane review of physical activity. They demonstrated that a broad range of control interventions are used in this area of research which has the potential to influence effect sizes, as control interventions may contain different BCTs. Future work should therefore consider the contextual equivalence of control and intervention groups in the field of exercise adherence, such as considered in the review by Nicholson et al (2017).

Updated results

Four further studies have been published since the initial systematic review search which ended in May 2017 and they add to the findings of this review. Of these, only two reported any theoretical underpinning behind their chosen intervention with Minetama et al (2019) the only study to report

positive results in an adherence measure for their intervention. They reported a significant difference in step count, although self-reported adherence was not significantly different. Therefore the conclusions of this review remain unchanged in the face of these additional studies.

3.5.1 Strengths and limitations

This systematic review used clear inclusion and exclusion criteria in addition to an appropriate risk of bias assessment tool. It also utilised the pre-defined BCTTv1 which allowed the effective categorisation and evaluation of the included interventions. Limitations of this study include the moderate to high risk of bias of included studies, particularly due to small sample sizes and therefore underpowered studies. Additionally it was not possible to undertake a meta-analysis as a result of the heterogeneous nature of both the interventions and the adherence measures. Previous studies have reported that a lack of robust measures of adherence for therapeutic exercise exist (Bollen et al 2014), adding to the challenge of identifying the effect of adherence interventions. A further consideration that was beyond the scope of this review is to consider adherence interventions in the context of health outcomes, in order to determine whether interventions to promote better adherence, also improve health outcomes, or at least do not cause harm. A further limitation relates to the risk of bias. It is possible that the author has over-estimated the risk of bias of included studies. As outlined above, lack of justification of sample size, or small sample sizes were included in the 'other' category as part of assessing risk of bias. Technically, it is suggested that sample size should not be included in risk of bias assessment (Higgins and Altman 2008). However, it is not uncommon for studies to include issues related to the sample in the 'other' section. A review by Babic et al (2019) found that comments on the sample were one of the most frequently used explanations for judgements made within the 'other' category. Which is in line with comments from Savović et al (2014), who's evaluation of the Cochrane Collaboration's tool assessing risk of bias, noted that there was variation in how the 'other' category was considered, with lacking of clarity on what details should be considered. Also, given that sample size is an important consideration in trials (Faber and Fonseca 2014), the author felt that it was important to record sample size issues as part of the assessment of included studies. Lastly only studies published in English were considered for this review due to the cost of paying for the translation of articles. It is possible that there may be studies published in other languages that would have changed the results of this review.

3.5.2 Future research

Interventions with a focus on feedback and monitoring produced significant results and these types of interventions need to be tested in adequately powered trials. Additionally there is a need for the development of exercise adherence interventions that are underpinned by appropriate theory. Finally, robust adherence measures that are valid and reliable need to be developed, to allow interventions to be adequately assessed.

3.6 Conclusion

This systematic review offers an overview of interventions to improve exercise adherence in older people. Interventions categorised in the feedback and monitoring groups of the BCTTv1 demonstrated positive effects on exercise adherence, however risk of bias limits their generalisability. The initial review up to May 2017 has subsequently been published (Room et al 2017) and updating this has not altered the conclusion that there is a need for better reporting, use

and development of theoretically underpinned interventions in the area of exercise adherence for older people. Robust measures of adherence are also required in order to adequately test these interventions.

4 Physiotherapists' perceptions of how adherence and non-adherence to recommended exercise affects their practice: A qualitative study

4.1 Summary

Potential steps to improve exercise adherence involve interaction between patients and therapists. It is therefore important to explore the problem from the perspective of physiotherapists in addition to the experience of the patient. This chapter explores the experiences of physiotherapists and how the adherence and non-adherence of their patients impacts upon their practice. Physiotherapists were interviewed and data from interviews are presented in this chapter.

4.2 Introduction

It was established in chapter 2 that exercise is a commonly used treatment for many MSK conditions, and that poor adherence to exercise programmes may limit their effectiveness. In chapter 3 it was outlined that many exercise adherence strategies found in the literature are not underpinned by relevant theories. When interventions were categorised using the BCTTv1, those in the feedback and monitoring category of this taxonomy demonstrated positive results, however it is unclear how much these, or indeed any behavioural approaches are used in clinical practice. It has been suggested that physiotherapists use a small number of BCTs to promote physical activity (Kunstler et al 2018), and it may therefore be reasonable to assume this is similar when considering approaches to exercise adherence. It would therefore be informative to explore physiotherapists' views of exercise adherence in clinical practice.

Previous qualitative work has explored patients' experience of exercise adherence. Sandford et al (2017) reported that patients described both enablers and barriers to exercise. Enablers included perceived benefit, incorporating exercise into a routine, longer follow up and more intensive feedback and monitoring. Barriers to exercise included a lack of motivation, a lack of suitable equipment, and experiencing pain. Little and Lewis (2006) explored attitudes, social support and barriers that had an influence on exercise adherence in older patients with cardiac disease. Support from family, friends and health care professionals were noted as being important for long-term adherence. This is in line with a more recent qualitative study by Littlewood et al (2014), which found that participants with rotator cuff tendinopathy were able to self-manage if their exercises were offered within a positive and supportive environment, if the reason for performing them could be understood, and if participants could effectively self-monitor.

As the therapist is likely to play a vital role in enhancing the enabling factors and overcoming the barriers, it is important to hear the voice of physiotherapists in research. However, the experience of the therapist has only rarely been represented in the literature. Dean et al (2005) undertook an interpretative phenomenological analysis (IPA) of patients and physiotherapists perceptions of exercise adherence in patients with low back pain. The key theme identified was that of time: time is a valuable commodity that should be used well. They identified the pressure of time faced by both the patient and physiotherapist as an important issue, with both groups having to consider how they spend their time. For the patient, finding time or being able to afford to spend time on exercise can be a challenge, particularly if other things are considered to be a priority. For the physiotherapists there is the pressure on taking time to establish a therapeutic relationship, which is felt to be important, balanced with the pressure to manage time and service provision overall. The authors

offer suggestions that therapists could consider for improving adherence. These included minimising the daily interruption caused by an exercise programme and understanding the importance of creating rapport to establish a therapeutic relationship. These suggestions are likely to be relevant beyond the field of low back pain, and it remains important to explore this area without limitation to a specific body region. Another study of physiotherapists' perceptions of patient adherence to self-management strategies (Peek et al 2017), reported that physiotherapists believed that adherence to treatment can affect outcomes, and that levels of adherence could be improved. However this was a quantitative survey study which did not use qualitative methods to explore in depth thoughts and experience. There remains little in the literature describing how physiotherapists view and experience their patients' adherence or non-adherence to the exercise they prescribe. Therefore the aim of this study was to address this gap by exploring physiotherapists' perceptions of how their patients' adherence or non-adherence to exercise affects their practice.

4.3 Methods

4.3.1 Design

An exploratory qualitative study that involved data gathered by an initial focus group with identified topics which were then explored in more depth by individual face-to-face interviews with a further ten participants. This approach has been used previously in qualitative studies to generate rich data (Barker et al 2017), and it has been suggested that this approach can enhance the richness of data and trustworthiness of findings (Lambert and Loiselle 2008). Both phases involved semi-structured interview techniques and followed a topic guide (appendix 3)

This study design and approach was set within an interpretive paradigm. An interpretive approach aims to understand the phenomena of interest as it is experienced by individuals (Rehman and Alharthi 2016). Human behaviour is complicated and variable (Green and Thorogood 2009) and this approach assumes that people create meaning in relating to and with the surrounding world, and therefore there is no distinct singular reality (Lapan et al 2011). This approach was used in order to explore exercise adherence and non-adherence from the perspective of physiotherapists as they experience it in their clinical life. The steps taken in the design, conduct and dissemination of this research have been guided by the Consolidated Criteria for Reporting Qualitative Studies (COREQ) Checklist (Tong et al 2007) (appendix 4)

4.3.2 Ethics

The study described in this chapter received ethics approval from the Faculty of Health and Life Sciences Research Ethics Committee (FREC), Oxford Brookes University 2017/07.

4.3.3 Participants

A convenience sample of eighteen physiotherapists working in the UK who treat older patients with MSK conditions were recruited to the study. Participants were recruited using posters in physiotherapy departments and via posts on social media. Physiotherapists who contacted the author were sent a participant information sheet. If they were still happy to take part, a convenient date for the focus group was arranged or a time for an interview was scheduled. All participants gave written informed consent prior to their focus group or interview.

4.3.4 Data collection

A focus group and semi-structured interviews were chosen as the methods for collecting qualitative data. The focus group made use of group dynamics to produce conversation and generate ideas, allowing a broad range of thoughts to be considered (Freeman 2006). It helped to generate initial ideas that could be probed further in individual interviews. Semi-structured interviews allowed for a more in-depth discussion and the generation of rich data from participants (Howitt 2016) and were used to gather views on their day to day clinical experiences. Both the focus group and interviews were conducted in a hospital setting and were directed by a topic guide, and participants were encouraged to discuss anything that they felt relevant to the topic. All were conducted by the first author (JR), a male physiotherapy researcher and PhD student with previous experience of qualitative methodology and all participants were aware that he was a physiotherapist and the researcher undertaking this study. JR also made field notes during the focus group and interviews which were audio recorded and transcribed verbatim. Transcription was undertaken by JR, JM a male physiotherapist and researcher and KA a female physiotherapy student. All transcripts were checked for accuracy by JR. The focus group lasted 51 mins 49 seconds and the interviews lasted between 29 mins 21 seconds and 41 mins and 2 seconds.

4.3.5 Data analysis

The data were analysed using thematic analysis as described by Braun and Clarke (2006). This involved six steps: transcribing the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report. This is a commonly used approach to analysis, with the advantage of being flexible and accessible (Nowell et al 2017). The approach was inductive with the research working from the data towards the theory or results (Morse 2012), rather than a deductive approach working from preconceived ideas toward specific conclusions (Searle 1999). However, this doesn't mean than the researcher was completely separate from the process and this is discussed in section 4.3.6.

As JM was new to the process of coding JR and JM independently coded two transcripts by reading them and generating initial codes. They met to compare codes and check that JM was happy with the process. JR then coded the remaining transcripts. Sub-themes and themes developed from the codes were generated. These themes and sub-themes were discussed and refined by JR, JM, KA, MB (a female sociologist) and FT (a female anthropologist). Meetings were held to discuss agreements and disagreements in the themes and subthemes; KB, a female research physiotherapist was available if needed to resolve disputes.

Data analysis was conducted using word and tabletop organisation of data. Further details of data analysis are provided in appendices 5-8. Appendix 5 gives examples of coding from two transcripts, appendix 6 shows a list of 1st order codes generated after coding all transcripts, appendix 7 shows how codes were grouped into sub-themes and appendix 8 shows how sub-themes were grouped into themes.

4.3.6 Reflexivity

Reflexivity refers to the way that data collection and analysis can be influenced by the researcher (Pope and Mays 2006). For this reason, researchers may need to focus on themselves in order to understand the role that they have played in the generation of knowledge (Berger 2015). In this section the author will outline his position in relation to the research described.

The author is a Caucasian male physiotherapist and within his role he regularly recommends exercise to patients. In fact, all the work within this thesis was born out of a growing sense of frustration he had with the area of exercise adherence. This was coupled with a desire to do his best to help people stick to their exercise programmes. The author himself undertakes regular exercise and almost certainly doesn't experience some of the challenges, either physical or social, that are described by some populations within this thesis. He is in his 30's so is a long way from the target age group that is the focus of the research within this thesis. All of these factors will have affected his thinking and approach throughout the research process. They also could have influenced data analysis as part of this qualitative study. Therefore it is of note, that when the author refers to an inductive approach it is used in the same way described by Braun and Clarke (2020), that of being grounded in the data, and not purely inductive. This is because it is not possible to enter a theoretical vacuum whilst undertaking thematic analysis. The author himself, and the factors outlined above, will all have been part of the interpretive approach to the data.

4.4 Results

Eight physiotherapists took part in the focus group and a further ten physiotherapists took part in the semi-structured interviews. Participant demographics are given in table 4.1.

Table 4.1 Participant demographics

	Focus group	Semi-structured interviews
Gender (Male/Female)	1/7	2/8
Age (Years)	38 (SD 9, range 24 – 48)	37 (SD 10, range 28 – 52)
Years of experience (Years)	13.5 (SD 8.1, range 2 – 25)	14.7 (SD 9.6, range 2 – 31)
Work settings	MSK Outpatients NHS x4 Orthopaedic Clinic NHS X2 Private Outpatients x1 Inpatient Orthopaedic NHS x1	MSK Outpatients NHS x3 Hand therapy NHS x2 Private MSK x 1 Orthopaedic clinic x1 Pain rehabilitation NHS x 1 Elderly rehabilitation/day hospital x 1
Geographical location	South England x 8	South England x 4 Scotland x 2 Midlands x 1 London x 1

Four themes were generated from the data: 1) A challenge but worth it 2) It's frustrating but you can't win them all 3) Striving to see the individual 4) Striving to help the patient. The themes and sub-themes are outlined in table 4.2. Each theme is discussed and illustrated with quotes from participants below.

Table 4.2 Themes and sub-themes

A challenge but worth it	It's frustrating but you can't win them all	Striving to see the individual	Striving to help the patient
Short-term cost for long term gain	Frustration	Know the individual	Collaboration
It's bigger than the individual	Questioning professional identity	Expectations	Fostering self-efficacy
Hard to measure	Need for resilience	Individual barriers	Clinical reasoning
Adherence is rewarding when it occurs		Tailoring treatment	Goal setting

4.4.1 A challenge but worth it

This theme outlines the challenge that physiotherapists described when talking about exercise adherence and their practice. They talk about the difficulty they had in trying to help people adhere to exercise and acknowledged that responses are variable, and in their experience poor exercise adherence is reasonably common.

> *A number of people that are very compliant…er…and adhere to all the exercises…Equally I see quite a lot of people that are very low in mood and motivation, that equally aren't half as adherent to the exercises that we sort of are proposing to them. So I would say its variable (Interview Physiotherapist 13)*

Participants described potential difficulties in attempting to persuade patients to exercise as it involves an immediate cost to the patient, whether in time, effort, or money, with no guarantee of improved or maintained symptoms, or that exercise will resolve the patient's problem. The prospect of this short-term cost balanced against a possible, but not guaranteed, long-term gain is one of the challenging aspects of achieving exercise adherence in practice.

> *I'm always realistic and say it can take this long before you'll get stronger, but I always say our standard stock phrase. I don't have a crystal ball because you could be a lot stronger but the pain could still be the same (Interview Physiotherapist 9)*

> *There is no immediate response either…you know you do it [the exercise] but you don't see the benefits (Focus group Physiotherapist 8)*

Participants acknowledged that this challenge is also compounded by many factors including social and cultural influences. They realised that trying to change behaviour is difficult and something everyone struggles with. It is therefore understandable that someone may find it difficult to adhere to an exercise programme.

> *…societal behaviour and political behaviour or attitudes affect it..like…if they're from a family that's very active…and the, the polit…the environment they've grown up, they've always had an active lifestyle (Interview Physiotherapist 15)*

> *I struggle to sometimes motivate myself to exercise and most people at times do…(Interview Physiotherapist 10)*

These challenges are compounded by the difficulty in assessing adherence. Measuring exercise adherence is not necessarily straightforward. If a patient has done either exactly as advised or nothing at all, it is easy to categorise adherence or non-adherence. However clinical life is not always so black and white. It can be hard to define exactly what constitutes adherence, or identify the ranging degrees of adherence and non-adherence.

> *…you know they are adhering to a degree but it depends on where you draw the line of adherence (Interview Physiotherapist 11)*

> *Hard to measure, which is so frustrating…and no-one's thought of a good way of measuring it to be honest…and there's no way to measure how someone does their physio exercises (Interview Physiotherapist 10)*

These factors outline how the issue of exercise adherence can be challenging in clinical practice, and for this reason, participants found it particularly rewarding when a patient succeeded in adhering to their exercise programme.

> *But when it happens, it's just the best…the best feeling and they just do so well (Interview Physiotherapist 14)*

4.4.2 It's frustrating but you can't win them all

In this theme participants described the effects that non-adherence to exercises could have on themselves, including feeling frustration, causing them to question their own professional identity and realising that there is a need to remain resilient.

Participants talked about how frustrating it was when a patient didn't take their advice and had not adhered to the exercises recommended.

> *It's more frustrating when people attend appointments having been non-adherent… and they've taken a bit…they've wasted a bit of their own time and yours, by attending an appointment that they've not participated in the treatment for…(Interview Physiotherapist 12)*

They felt under pressure and could almost blame themselves when a patient acknowledged non-adherence.

> *…from a physio point of view there is always that internal little bit of pressure, of like, well am I engaging this person to want to adhere to their exercises (Focus group Physiotherapist 4)*

This has the potential to lead them to question professional identity and feel unsuccessful. They described the sense of challenge to their professional competence and identity in the face of non-adherence.

> *…disheartening, but not because they're not doing what I want them to do, it's disheartening because I want to help them and, and I feel like I'm not being successful at what I'm doing (Interview Physiotherapist 13)*

> *…if they're not engaging really it's very difficult to know the route to take through, to make them or to encourage them to engage more (Interview Physiotherapist 17)*

Participants therefore had to be resilient. They describe how they could do as much as possible but no more. If the patient doesn't change their behaviour despite the physiotherapist using all the exercise adherence strategies available to them, then sometimes you have to let it go. Participants described how they learnt this from experience.

> *Me personally, I'm getting better at saying 'well, I've done my job' so I don't take it so personally anymore (Interview Physiotherapist 15)*

4.4.3 Striving to see the individual

In this theme physiotherapists described the importance of understanding and treating the patient as an individual in relation to exercise adherence. It was felt that understanding the individual and what is important to them was crucial to a successful clinical encounter.

The physiotherapists interviewed felt it was critical to try to get to know the individual patient.

> *…like find out what their hobbies are…I mean with some people you've got to dig it up haven't you, so they might say 'oh I just watch eggheads and do a crossword' and its really tricky then to probe because they're, you know some people actually do just sit at home all day every day and do feel isolated (Interview Physiotherapist 12)*

> *…there's no right answer is there cause we're all so different as human beings and our past experience, what just makes us who we are isn't it and what works and what doesn't work (Interview Physiotherapist 14)*

Part of trying to get to know the individual is gaining an understanding of the patients' view of exercise, and their expectations of physiotherapy treatment. Knowing who people are and what is important to them can help to decide how to try to move forwards.

> *…patients will come and say I think you're gunna give me exercises but that doesn't necessarily mean they wanna…you know…when you do their expectations part of the assessment, they might say they're expecting it but it doesn't mean they necessarily have a strong belief that its helpful…(Interview Physiotherapist 18)*

> *…sometimes the public perception is you love exercise and you find it really easy to exercise and I think patients maybe sometimes worry about saying "well actually I don't really like exercise" (Interview Physiotherapist 10)*

It can also help with selling exercise as a viable treatment option by linking it to the person's individual goals and values.

> *…like selling them the story of why these exercise are going to help them achieve their goal which you've obviously taken into account the values and beliefs about what's important to them (Interview Physiotherapist 12)*

In addition to this, it allowed patients to discuss any perceived barriers to exercise. Factors such as time, motivation, pain, finance and the desire for a quick fix were seen as common barriers to adherence by the physiotherapists.

> *…the people that don't are either wanting a quick fix, don't particularly necessarily want to engage themselves (Interview Physiotherapist 7)*

> *Yeah, pain, time...finances, globally, globally across them all (Interview Physiotherapist 15)*

> *Time. Err, motivation is a massive one, erm, if they can't feel that its working (Interview Physiotherapist 16)*

Participants recognised that patients could encounter these difficulties in adhering to their exercises and sought to discuss and try to resolve them. They saw value in monitoring patients' progress over the longer term in order to identify barriers and help them overcome them.

> *…so if people come back to me and say that they're struggling, we'll sit down and kind of write things down, why are you struggling and that's had a positive impact with certain patients who've said its really useful to sit down and actually work out a time when I can do my exercises, how can I fit it into my day and writing it down, rather than just having a verbal conversation…(Interview Physiotherapist 10)*

An additional benefit in knowing the individual and taking account of potential barriers to adherence is that participants felt able to attempt to tailor treatment to the individual in front of them.

> *So it's kind of exploring their values and beliefs and trying to make sure you're tailoring a goal to that (Interview Physiotherapist 12)*

> *So coming back to their goals, like what motivates them… otherwise, you're never gonna do something and what might be important to one person…like walking their dog, another person might wanna do ballroom dancing…(Interview Physiotherapist 10)*

4.4.4 Striving to help the patient

In this theme physiotherapists described the strategies they have used in their practice in response to the challenge of exercise adherence, including the steps they take to facilitate better exercise adherence.

The importance of establishing a good working relationship with patients was outlined. This included working collaboratively with the patient, avoiding blaming them for non-adherence and thinking about the language they used in discussing exercises.

> *…I think the only thing is the relationship with the patient, how good your relationship is, is how adherent, and I think the people who are most adherent are people that I get them and they get me (Interview Physiotherapist 18)*

> *…so definitely I don't try and guilt trip them into doing them next time, and sort of have a bit of a laugh and say 'yeah you know that's fair enough, I've tried to start new habits or break bad habits and failed plenty of times…'(Interview Physiotherapist 11)*

Being honest about the challenge of exercise adherence was another important part of collaborative practice. It was felt that it is better to acknowledge that it is hard to change behaviour and stick to an exercise programme. Rather than pretend it's easy and hoping things will work out, the participants describe being upfront about these difficulties.

> *…some patients will say to you "I really struggle to do exercise", but often they won't ever talk to you about that, unless you bring it up…(Focus group Physiotherapist 2)*

> *…cause we're all busy, and I don't do exercises that I know I should, so, why should they (Focus group Physiotherapist 6)*

In talking about the desire to help patients, physiotherapists spoke about the need to foster self-management, to empower the patient to be able to manage their exercise programme, to facilitate self-efficacy and motivation in their patients, and to avoid the desire to attempt to fix the person.

> *There is only a few times where we can actually make a difference, where we do something to them and they don't have to do anything else, and they get the outcome they…the desired outcomes, so it has to be input from them, or work on their side as well (Focus group Physiotherapist 3)*

> *…just actually you know going through the exercises with the patient in clinic, make sure we have enough time to do that, that sort of demonstrates that mastery to them that they can do it…(Interview Physiotherapist 11)*

The importance of clinical reasoning in relation to exercise prescription was outlined by several physiotherapists. In particular they described a journey where they had moved from giving out 'loads' of exercises, to giving out fewer with the hope that adherence would be easier. Other considerations such as the capacity of the patient were discussed.

> *I'm much more confident talking about it now…or much more aware of it, and I think well there's no point in giving you hundreds of exercises that you're never gonna do…(Focus group Physiotherapist 2)*

> *...have they got the range of movement to be able to do something, you know, there's no point giving them squats when they've only got 20 degrees of knee flexion (Focus group Physiotherapist 6)*

Part of this reasoning process is considering the patients goals. Participants recognised the importance of setting goals for both the patient and themselves. In particular, they wanted to know what the goal, or goals, were and why they were important to the patient

> *What their goals are and...why? What the purpose of having those goals are? We have people that come and that their goals are to build up core stability and core strength, erm which begs the question why?...Why do you want to do that? What's the purpose behind it? Is it that you want to play with your grandchildren? (Interview Physiotherapist 13)*

> *I think it's important that you agree on a goal, so that you've got one thing in common (Interview Physiotherapist 9)*

4.5 Discussion

This chapter has explored perceptions of physiotherapist who prescribe exercise to older adults, on how adherence or non-adherence to exercise affects their practice. Four themes were generated: (1) A challenge but worth it (2) It's frustrating but you can't win them all (3) Striving to see the individual (4) Striving to help the patient. In these themes participants discuss exercise adherence as a challenging area and one that can affect their practice. They outline several strategies that they use to help facilitate better exercise adherence in their patients. Their aim to help patients in this difficult area of practice underlines the need for the development of robust evidence based interventions in the field of exercise adherence.

A challenge but worth it

Participants spoke about several factors that made exercise adherence feel like a challenge. This challenge is initially highlighted by the fact that physiotherapists reported varying levels of adherence to exercise, with poor adherence being relatively common but in line with other studies reporting sub-optimal adherence (Alexandre et al 2002, Peek et al 2020, Sluijs et al 1993).

Participants described the difficulty selling a treatment that involved short-term 'cost', such as hard work, time and potentially pain, for the potential of longer-term gain, such as better health. In the field of behavioural economics it has been demonstrated that, in general, people tend to choose smaller 'rewards' that are immediate or short-term, rather than larger 'rewards' that are further away in time. This idea is the basis of the theory of hyperbolic discounting or what has been described as 'present-biased preferences' (O'Donoghue and Rabin 2011). This idea is relevant to exercise engagement, where the decision to undertake exercise with a potential long-term reward is more difficult than deciding to undertake a behaviour that is more immediately rewarding, such as sitting on a sofa and watching a film. Physiotherapists may have been interpreting this kind of decision making in their patients in relation to exercise adherence. To help in this area they may want to consider if it is possible to make exercise programmes more immediately rewarding, for example making them more enjoyable, creating programmes that allow for social interaction, or by making the connection between the short term cost and the long term goal clearer.

Attempting to change behaviour is something we all struggle with, in many areas of our lives. We know that as a population many of us display poor health behaviours in areas such as physical activity, obesity, alcohol consumption and smoking (NHS Digital 2017). In short, difficulty with changing behaviour seems to be a challenge that we all share. It is a part of being human, not something isolated to patients trying to undertake an exercise programme. This idea was recognised and discussed by the physiotherapists. Potentially these thoughts may have been influenced by the fact that most of the participants had undergone the Make Every Contact Count (MECC) training (Public Health England 2016), which may have served to highlight these kinds of issues. However, acknowledging the issue of adherence to exercise as a broader behaviour change challenge, rather than solely a specific problem faced by patients, may help physiotherapists to empathise with their patients. This in turn may help to facilitate collaborative working, as opposite to adopting a didactic approach.

Adherence was also seen as being about more than dealing with the individual in front of you. There are many factors that can shape a person's health behaviour including wider social and cultural

influences (Hogg and Vaughan 2018). For example, socioeconomic disadvantage, including variables such as unemployment, poverty and being from a minority population, has been associated with low levels of adherence to pulmonary rehabilitation for COPD patients (Oates et al 2017), and adherence to exercise especially in older people has been shown to be affected by socioeconomic status (Picorelli et al 2014). This appears to be what participants felt in regard to their experience of exercise adherence: that engaging in exercise is not something you can just talk someone into, which adds to the challenges described.

Another challenging aspect was the difficulty in quantifying adherence: trying to measure adherence raises questions about what counts as adherent or at what point non-adherence shifts to adherence. A recent systematic review highlights the difficulty in defining the concept of adherence (Bailey et al 2018), and Bollen et al (2014) outline the lack of robust outcome measures for exercise adherence in their systematic review.

These factors combined led to participants describing exercise adherence as a challenging aspect of their clinical practice. Given the low levels of exercise adherence reported in the literature (Alexandre et al 2002, Sluijs et al 1993), it is likely that clinicians will experience this challenge as part of their daily clinical routine. It may therefore be sensible for physiotherapists to acknowledge this challenging area of practice, as a first step, before considering what strategies or approaches they can take.

It's frustrating but you can't win them all

Participants described the effect this challenge had on them as physiotherapists, reporting frustration when patients hadn't followed their advice. This frustration came partly from questioning their own professional identity: participants could feel that their proficiency as a physiotherapist was threatened if they were not able to help their patients to help themselves. To add to this there can be the feeling of pressure to engage the patient, or the feeling of being stuck and not knowing where to turn. In their study on the construct of professional identity of physiotherapists, Hammond et al (2016) suggests that identity as constructed by the individual is influenced by their feelings and the attempt to understand the interplay of both personal and professional identities and experiences. They argue that a strong sense of what we believe, value and know, can be developed by discussing ethical and moral reasoning in the workplace. The experience of exercise adherence and the frustrations that may come with it could be an area where such discussions can take place. Participants did speak of the need for resilience, realising they can do a good job, but they cannot make someone change their behaviour. Recognising this enables them to stop 'taking it personally'. The importance of resilience for wellbeing in the h0elping professions has been outlined by Grant and Kinman (2014) and it would seem sensible for physiotherapists to seek appropriate steps to become, and to remain, resilient in this area of their practice.

Striving to see the individual

Participants discussed at length the importance of understanding the person sitting in front of them. It was felt that understanding the individual, their expectations of physiotherapy treatment and exercise was crucial in attempting to facilitate better exercise adherence and the importance of personal 'internal' facilitators and barriers to exercise has been outlined previously (Petursdottir et

al 2010). In this qualitative study personal factors such as motivation and attitude towards exercise could be a facilitator or a barrier to engaging in exercise, for individuals with OA. The importance placed on treating the individual led participants to describe how they tailored the treatment or advice they gave. This is in line with recommendations from NICE's individual approaches for behaviour change (NICE 2014), which suggests tailoring interventions to meet the needs of patients, through steps such as assessing their individual physical and psychological capacity to undertake the change. The need for a 'toolbox' approach to adherence has been trialled for exercise and physical activity adherence in those with knee OA (Foster et al 2014). Physiotherapists may want to consider adopting approaches such as these which allow the use of any number of strategies to tailor their treatment to the individual.

Striving to help the patient

In the face of the challenge described above and in order to treat the individual, participants talked about reflecting on their own practice. This included the need to try to work collaboratively with patients, to consider the language they used, and to work alongside them, not looking to blame. This involved being honest and upfront about how challenging it can be to change behaviour, avoiding the desire to fix and trying to work with patients to set and achieve goals. Within this theme participants outlined several steps that they use to facilitate better exercise adherence. These included attempting to foster self-efficacy and motivation, to give clinically reasoned exercise programmes, to use goal setting, and sell exercise as a viable treatment that links to the patient's goals. In addition they would try to help patients overcome barriers, which was also linked to feedback and monitoring. Several of these steps are supported by evidence and collaborative steps such as giving the patient the opportunity to summarise their programme can help with adherence (Peek et al 2020). Self-efficacy and goal setting have long been recognised as crucial in health behaviour change (Strecher et al 1986), while feedback and monitoring have shown the potential to improve adherence to therapeutic exercise (Room et al 2017). Clinicians should consider these various approaches in their practice in order to facilitate improved exercise adherence. Their desire to help patients in this challenging area underlines the importance of developing and evaluating evidence-based interventions, to help them facilitate adherence to exercise in the patients they see.

4.5.1 Limitations

A convenience sample of 18 physiotherapists was selected to allow for the project to be completed on limited time and resources. An alternative approach would have been to have used a purposive sample. In a purposive sample participants are approached on the basis of that they are likely to provide rich information relevant to the topic of interest (Palinkas et al 2015). This may have allowed for a sample that was more representative whereas a convenience sample may have meant some relevant views were not heard. Although a convenience sample was used it included physiotherapists with a wide range of age and years of experience. However, the majority worked in the South of England and 15 of the 18 participants were female.. The study only recruited qualified physiotherapists and therefore may have missed some relevant views on the topic. It could have benefitted from recruiting physiotherapy assistants and technical instructors who can also lead exercise with patients (Chartered Society of Physiotherapy 2020). In addition data was not collected on the ethnicity of the sample, meaning its representativeness could be questioned, which in turn may limit the transferability of the results.

4.5.2 Conclusion

Patient non-adherence to recommended exercise may be a challenging aspect of clinical practice for physiotherapists who prescribe exercise to older adults. However, they have been shown to acknowledge this challenge, and the potential frustrations it may bring, yet remain resilient in the face of it. Clinicians may want to attempt to tailor exercise adherence strategies to the individual patient. Considering the steps discussed in this paper to attempt to facilitate improved adherence to recommended exercise. In the meantime there remains a need for robust interventions to help clinicians and patients in this area of practice.

5 The development of an exercise adherence intervention for older people with musculoskeletal conditions: The Adherence for Exercise Rehabilitation in Older people (AERO) intervention

5.1 Summary

Earlier chapters have outlined the importance of exercise adherence (chapter 2), the lack of theoretically underpinned exercise adherence interventions in the literature (chapter 3), and the need for robust interventions to aid clinicians in the area of exercise adherence (chapter 4). This chapter will describe the steps taken in the development of an exercise adherence intervention for older people with MSK conditions. It will be presented in two parts. In the first, the justification for the chosen intervention development methodology is given. The second will outline how the chosen methods were used to develop the AERO intervention, and what it consisted of.

5.2 Part 1: Justifying the chosen methodology

The AERO intervention was developed using an Intervention Mapping approach (Bartholomew Eldredge et al 2016). The process undertaken by the author led to an intervention that consisted of a brief behavioural assessment informed by the Behaviour Change Wheel (BCW), and in particular COM-B (Michie et al 2011). This assessment formed part of a standard out-patient physiotherapy session, and participants were given targeted exercise adherence strategies based on the outcome of the assessment. The intervention itself is outlined in detail in part 2 of this chapter.

5.2.1 Intervention Mapping

Taking the appropriate steps when developing an intervention in health care is important for a number of reasons, among them is reducing the risk of using ineffective interventions and reducing research waste (Wight et al 2015). There are a number of approaches that can be adopted when developing health related interventions. This point is confirmed by a recent systematic methods overview which reviewed intervention development methods that have been used in the field of health improvement (O'Cathain et al 2019). The authors reviewed and reported a number of approaches to intervention development which were categorised into a taxonomy comprising of eight categories, these were: 1) Partnership, 2) Target population centred, 3) Theory and evidence-based, 4) Implementation-based, 5) Efficiency based, 6) Stepped or phased based, 7) Intervention-specific, 8) Combination. This highlights the broad range of options that could be available to those developing health related interventions. There are a number of reasons why the author chose an Intervention Mapping approach and these are discussed below, along with the considered alternatives. They are summarised in table 5.1.

The primary reason why an Intervention Mapping process was chosen was the structure it offered to the intervention development process. This structure allowed the author to consider relevant information, and it decreased the risk of missing important evidence during the process. The author has a strong clinical background and therefore can have the propensity to adopt a common clinical trait of seeing a problem and 'just doing something'. This has been described by Charon (2008) as the irresistible impulse to "*roll up our sleeves and do something*". Even though this was used to describe clinicians in the specific area of responding to the patient faced with illness and suffering, it is of relevance to the author in the intervention development process. The impulse to adopt a

pragmatic approach and act without stopping to consider the problem is clearly undesirable when developing an intervention, as it increases the risk of not considering appropriate sources of information and approaches. This has the potential to increase waste and produce low value research (Ioannidis et al 2014). However, using the structure offered by an Intervention Mapping approach mitigated this risk.

A second reason for using this approach, which was linked to the primary reason, was the need to produce an evidence-based intervention. Chapter 2 has already discussed the need for better reporting, use, and development of theoretically underpinned interventions with regard to older people's adherence to exercise (Room et al 2017). Intervention Mapping is a framework which helps those designing health promotion programmes to make effective decisions in the planning, implementing and evaluating stages (Bartholomew Eldredge et al 2016). A part of making these effective decisions was considering the relevant theory and evidence, in addition to considering the views and experiences of patients and clinicians. In this way the process helped with designing an intervention that took account of the pillars of evidence based practice, the best available evidence, clinical expertise, and patient preferences and values (Sackett et al 1996). In fact, as an approach, Intervention Mapping was categorised within the evidence-based category of the taxonomy of intervention development approaches, in the review outlined by O'Cathain et al (2019).

Finally, Intervention Mapping has been used as the approach to develop interventions in studies looking at the initiation and maintenance of physical activity. Examples of this include the IMOVE intervention, which was a web-based tailored physical activity intervention (Friederichs et al 2014), the Active Plus intervention, a tailored physical activity promotion intervention to raise awareness of insufficient physical activity and increase initiation and maintenance of physical activity in those over fifty (van Stralen et al 2008), or the intervention developed by McEachan et al (2008) that aimed to increase levels of moderate intensity physical activity for those in sedentary occupations. Although physical activity and exercise are separate constructs (Caspersen et al 1985), there is clearly an overlap and the author was encouraged by the number of interventions in the field of physical activity that have been systematically developed using Intervention Mapping.

With all approaches there are likely to be both drawbacks and benefits. One of the criticisms levelled against Intervention Mapping is that it can be time and resource intensive (Wight et al 2015). Whilst this may be the case, the authors of the Intervention Mapping approach encourage intervention developers to use the approach within the time and resources available to them (Bartholomew Eldredge et al 2016). Other approaches may have been less time consuming, but this was balanced against the desire to consider all pertinent information as discussed above.

Other approaches were considered to direct the development of the AERO intervention. Firstly, consideration was given to using the BCW (Michie et al 2014). The BCW, or at least the COM-B aspect of it is used as the theoretical underpinning for the AERO intervention, and this is discussed below. However, the BCW could have been used solely as the basis on which to develop the intervention. The BCW offers a step by step guide to developing an intervention. An approach that the authors of Intervention Mapping described as comparable with an Intervention Mapping approach (Bartholomew Eldredge et al 2016). However, the author felt that using the BCW in isolation may have resulted in using COM-B without considering all the relevant theory and

evidence. Opting for Intervention Mapping over the BCW in isolation maximised the chance of considering all the relevant theory and evidence which could feed into the intervention.

A second approach considered was the six essential Steps for Quality Intervention Development (6SQuID) (Wight et al 2015), which outlines 6 steps that should be taken in the design of public health interventions. These are:

1. Define and understand the problem and it's causes
2. Clarify which causal or contextual factors are malleable and have greatest scope for change
3. Identify how to bring about change: The change mechanism
4. Identify how to deliver the change mechanisms
5. Test and refine on a small scale
6. Collect sufficient evidence of effectiveness to justify rigorous evaluation/implementation

The author was drawn to this approach as a potential pathway for the AERO intervention development, particularly as Wight et al (2015) describe their own intervention as a 'pragmatic guide' for developing quality interventions. There is undoubtedly considerable overlap when reviewing the 6 steps suggested by 6SQuID, with the 6 steps that form the Intervention Mapping approach. However, the author chose an intervention mapping approach, as it was potentially more rigorous. In fact, Wight et al (2015) in their paper outlining the 6SQuID describe intervention mapping as an *'extremely rigorous and elaborate approach to intervention development'*.

Table 5.1 Intervention development approaches considered

Approach	Potential Positives	Potential drawbacks
Intervention mapping (Bartholomew Eldredge et al 2016)	Rigorous, structured approach allowing the consideration of relevant information	Time and resource intensive
Behaviour Change Wheel (Michie, Atkins, et al 2014)	Structured step by step process	Possible that theories outside of COM-B may not have been considered
6SQuID (Wight et al 2015)	Pragmatic, structured approach	Less rigorous than intervention mapping

5.2.2 COM-B

There were a number of theoretical approaches that fed into the development of the AERO intervention and these are outlined in step 3 of this chapter (section 5.6). However, the intervention is primarily underpinned by COM-B (Michie et al 2011) so a justification of the choice of this theory is given before the details of how it was used. An alternative theory that was considered, the Health Action Process Approach (HAPA) (Schwarzer and Luszczynska 2008) is also outlined along with reasons for the final choice to use COM-B.

In 2011 Michie et al (2011) developed the BCW, a framework for developing and categorising behaviour change interventions, developed from a synthesis of 19 existing behaviour change

frameworks. At its centre the BCW has the COM-B model. It posits that for behaviour to take place, the individual or individuals require the capability, opportunity, and motivation to perform the behaviour. There are a couple of reasons that COM-B was chosen as the theory to underpin the AERO intervention. Firstly the theory is accessible to clinicians who may not have an in-depth understanding of behaviour change theory. The AERO intervention was used in a clinical setting. Although some physiotherapists may have an understanding of behaviour change, and it has been noted that physiotherapists use a small number of BCTs in areas such as physical activity promotion (Kunstler et al 2018), it is also likely that many physiotherapists will have little understanding of behaviour change theory. It has also been argued that although behavioural approaches should be key, they are often missing from physiotherapy rehabilitation (Bassett 2015). In the UK it is likely that many physiotherapists have received MECC training, an approach that aims to make use of the many interactions that organisations like the NHS have with members of the public, in order to encourage positive health changes (Public Health England 2016). This training may have exposed them to behaviour change approaches, although without the need to understand the theory behind them. This compelled the author to consider approaches that could be readily understood and implemented by the clinician. The importance of this is amplified as the AERO intervention involved clinicians undertaking a brief behavioural assessment of the participants based on COM-B, and then offering targeted exercise adherence strategies based on the assessment. As clinicians and not academics or researchers were undertaking this it was important that the theoretical approach was understandable and accessible to them. The domains in COM-B of capability, opportunity and motivation were all constructs that clinicians could understand, and this was demonstrated in the qualitative work (section 5.2) that took place during the intervention development process. Secondly the COM-B approach lends itself to an intervention that can tailor exercise adherence strategies to the individual, which was one of the aims of the AERO intervention. The importance of tailoring any intervention was another aspect that became clear during the qualitative work. With COM-B, participants could be offered exercise adherence strategies falling within the different domains of capability, opportunity and motivation.

The main alternative approach that was considered was HAPA (Schwarzer and Luszczynska 2008). This is a social cognitive model that breaks down changing health related behaviour into intention to undertake the behaviour, initiating the behaviour and maintaining the behaviour. In this way it can be divided into a motivational and volitional phase, and self-efficacy, one's belief in their ability to achieve a specific task or goal (Bandura 1977), could be considered depending on the different stages. In the model these different views of self-efficacy are described as pre-action self-efficacy, maintenance self-efficacy, and recovery self-efficacy. This model could potentially work well with an exercise adherence intervention, as patients need to feel confident that they can initiate and maintain an exercise programme, and also potentially recover from a relapse should they experience one. The model has also been considered in relation to physiotherapy rehabilitation (Bassett 2015) and it was considered as the basis of the AERO intervention. The main reason that the COM-B was chosen over the HAPA was that the COM-B model was assessed as being easier for the clinician to grasp, and as outlined above, this was an important consideration for the author if the intervention was to be used clinically.

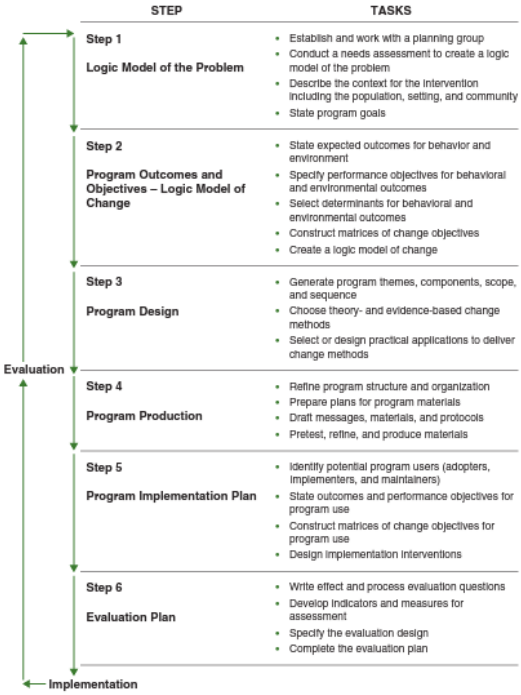
5.3 Part 2: Steps taken in the development of the intervention

As discussed in part 1 of this chapter an intervention mapping approach was used as the framework to guide the development of the AERO intervention. The process of developing the intervention will now be discussed. The Intervention Mapping approach is a process consisting of six steps (Bartholomew Eldredge et al 2016):

1. Conducting a needs analysis
2. Creating programme objectives
3. Choosing relevant theory and considering practical application
4. Producing and refining the programme components and materials
5. Considering programme implementation
6. Developing an evaluation plan

These steps are outlined in figure 5.1. and the process resulted in the AERO intervention which is underpinned by the BCW (Michie et al 2011). It aims to help physiotherapists facilitate improved exercise adherence for older people with MSK conditions, by targeting exercise adherence strategies to the individual patient based on a brief behavioural assessment. Steps 1 to 4 are described in detail in this chapter. Steps 5 and 6 are briefly considered but will be outlined in further detail in chapter 6.

Figure 5.1 Intervention mapping steps taken from Bartholomew Eldredge et al (2016)



5.4 Step 1 - Intervention Mapping: Needs analysis

Step 1 of the intervention mapping process involved conducting a needs assessment. Information on the potential factors that could affect adherence to exercise in older people with MSK conditions was gathered. This information was sought from two main sources. The first was through a review of

pertinent literature on the topic of exercise adherence, and the second involved seeking the views of relevant stakeholders, through qualitative work. This consisted of one to one interviews and two focus groups, one with physiotherapists, and a second with patient representatives. Both aspects of the information gathering are described below.

5.4.1 Relevant literature

The literature in the field of exercise adherence highlights a number of factors that have the potential to affect adherence in older people. The relevant papers and their findings have been highlighted in chapter 2 (section 2.2.2) and chapter 3 (section 3.2). The literature discussed demonstrates the multiple variables that have the potential to affect exercise adherence in older adults. Some of the variables described relate specifically to the individual whilst others relate more to factors external to the patient, for example exercise programme characteristics, or exercise instructor behaviour. To this end, a wider perspective is required, such as that offered by intervention mapping (Bartholomew Eldredge et al 2016), where consideration can be given to the individual from the population of interest, but also to environmental agents, such as physiotherapists. It also highlights that there are a number of areas that a future intervention might try to target, for example it could be possible to consider an intervention that targets the location where people exercise most frequently, such as their home. Equally, it could be useful to consider interventions targeting physiotherapists or other healthcare professionals who prescribe exercise, and the characteristics of their exercise programmes.

5.4.2 Qualitative work

Information was also gathered from patient representatives and physiotherapists as part of a small scale qualitative study described below.

5.4.2.1 Qualitative study aims and objectives

The overarching aim of the qualitative study was to gather the views of stakeholders to aid in the development of a theoretically underpinned exercise adherence intervention.

The objectives were

- To seek the views of relevant stakeholders regarding exercise adherence in older adults with MSK conditions via focus groups and interviews
- To assess the feasibility of implementing an intervention underpinned by the BCW
- To assess the feasibility of measuring capability, opportunity and motivation in a clinical setting as outlined in the BCW framework
- To use these views to develop the intervention
- To seek the views of relevant stakeholders to refine the intervention of the draft version

5.4.2.2 Method

This work occurred in two phases. In round one, stakeholder views were sought to enable the development of an exercise adherence intervention for older people with MSK conditions. In round two, the developed intervention was reviewed by stakeholders, so it could be refined before piloting.

5.4.2.3 Round one

This consisted of two focus groups. The first consisted of patient representatives and was organised through a local branch of the National Ankylosing Spondylitis Society (NASS) (National Ankylosing Spondylitis Society 2019). The chair of the local branch was contacted and sent information about the focus group. Once the chair had reviewed the information and had any questions answered it was sent out to members of the local branch. Interested members were given a date for the focus group and informed consent was obtained prior to it taking place. There were a couple of reasons that the local NASS branch were considered for this project and a good group to speak to with regard to developing an exercise adherence intervention. Firstly, it included a large proportion of members who were 65 years or older. Secondly, the group contained people who exercised regularly. This made them an interesting group to speak to, as for whatever reason they have maintained exercise programmes over sustained periods of time. This is particularly interesting in light of the fact that many people with ankylosing spondylitis (AS) have experienced a delay in diagnosis or a misdiagnosis (Ogdie et al 2019), so it would be understandable if they were more sceptical of medical institutions or advice, including the advice to exercise.

The second focus group consisted of physiotherapists who prescribe exercise to older adults with MSK conditions. Recruitment for the second focus group took place via posters placed in physiotherapy departments staff areas and on Twitter. Interested physiotherapists contacted the investigator and were given further details. Those who were interested were invited to take part with informed consent obtained prior to the group taking place. Participants in both groups were asked about their views on the feasibility and acceptability of a potential intervention, including its components, e.g. the acceptable length of time, or any questions they would expect to be asked in relation to adopting and maintaining an exercise programme. Participants were free to discuss any aspect of the intervention, or their experience of exercise adherence that they felt was relevant. Both focus groups took place at the Nuffield Orthopaedic Centre in Oxford and were recorded and transcribed verbatim, prior to analysis.

In addition to the focus groups, 10 one to one interviews with physiotherapists who prescribe exercise to older adults with MSK conditions were undertaken. Physiotherapists were recruited in the same way as for the focus group and if happy to participate they were contacted with a suitable time for the interview with informed consent obtained before the interview took place. Interviews either took place face to face or using video calling software and were conducted at the Nuffield Orthopaedic Centre. In the interviews, participants were asked about the feasibility of both the proposed intervention and assessing capability, opportunity and motivation in a clinical setting. Also, they were asked about the acceptability of a potential intervention e.g. the time it could take and what questions patients should be asked. In addition participants were free to discuss anything that they felt relevant to the proposed intervention, or to the topic of exercise adherence. Interviews were recorded and transcribed prior to analysis.

5.4.2.4 Round two

In Round Two a sub-sample of participants from round one were asked to review a draft intervention and recommend any edits or changes that they felt would be beneficial.

5.4.2.5 Data analysis

Focus groups and interviews were audio recorded and then transcribed verbatim. The data was analysed using the six steps proposed by Braun and Clarke (2006) namely transcribing the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and producing the report (chapter 4, section 4.3.5 provides justification of this approach). The themes generated in Round One were used to develop a draft exercise adherence intervention. In Round Two each aspect of the intervention was reviewed by the participants who could decide if any aspects of the intervention should be edited, kept or omitted.

5.4.2.6 Clinical governance and ethical issues

This project received ethical approval from FREC, Oxford Brookes University ref: 2017/07

All Identifiable information was removed from transcriptions, and recordings and transcriptions were stored on university and/or NHS trust password protected computers and in a secure room which was locked when not in use.

5.4.2.7 Results

5.4.2.8 Round one

Four themes were generated relating to a potential exercise adherence intervention. These were 1) The need to tailor to the individual; 2) Practical considerations; 3) Challenges with incorporating behaviour change approaches; 4) Adopting a problem solving approach. Each of these themes are described below and are corroborated with quotes from the focus groups and interviews.

5.4.2.9 The need to tailor to the individual

Both patients and physiotherapists described the importance of being able to tailor treatments or interventions to the individual. The need for the future intervention to be flexible enough to deal with the person in front of the physiotherapists was clear. It was noted that we are all different, with different motivations, and different things that are important to us, therefore something that can account for the differences of the individual would be beneficial.

> *Yeah, so erm, highlighting what is important to them, on a greater level in life, and what impact their problems are having on their wider life. In order to, to get a good understanding and a good awareness of where their motivation may come from, so values is I guess (Interview physiotherapist participant 5)*

> *…it's what they value and can you link it to that so if the like…I don't know…like gardening can you do something that is gardening focused instead (Focus group physiotherapist participant 1)*

The patient representatives also describe how being asked questions about themselves and their lifestyle was helpful, it showed that the physiotherapist was interested in them and how exercise could fit best in their life.

> *I think when someone ask those questions* [about lifestyle and where exercise fits] *that is of benefit really because it shows the interest (Focus group participant 5, ankylosing spondylitis patient, 68 years old)*

5.4.2.10 Practical considerations

The need to take into account practical considerations when trying to facilitate better exercise adherence was discussed. Considering aspects such as where people need to go to exercise, or what equipment is needed, or the exercise instructions that patients were given was viewed as important.

> *It's the ease… it's the ease to get somewhere I mean it doesn't matter to some, but it needs to be easily accessible to people, so it's not a real big effort (Focus group participant 4, ankylosing spondylitis patient, 69 years old)*

> *Sometimes the diagrams don't really explain exactly what you have got to do (Focus group participant 8, ankylosing spondylitis patient, 79 years old)*

> *…like tie up a rubber band or something, and you say 'do you have anywhere at home you can tie this to?', 'no I don't but I'll find somewhere' then hopefully I'll remember the next time I see them you know how's it going with that exercise, because usually they say how their exercise is going, or I'm struggling to find somewhere to attach the bit of band to for example, then you try to think of other ways to get around It (Interview physiotherapist participant 1)*

5.4.2.11 Challenges with incorporating behaviour change approaches

The physiotherapists described potential challenges with integrating behaviour change approaches into practice, including time, skill and training. It was clear that a future intervention would need to be easy to use, not time consuming, and that training would need to be part of an intervention package.

> *…if we had 2 hours per patient we'd be amazing at it, but we suddenly have half an hour and think "oh, I really want to do it now" but okay I've got 10 mins I can't really go deeply into this (Focus group physiotherapist participant 6)*

> *I think it could be quite difficult if, if you're back-to-back with a hundred patients a day, it could be quite difficult to do that cause it's not necessarily something that's part of our training either (Interview physiotherapist participant 5)*

> *I suppose it's highlighting that some things physio-wise we're quite good at, and then the motivation thing, well we can think we're good at [it]…goal setting is something that we talk a lot about, but are we actually very good at goal setting? Probably not, I don't think (Interview physiotherapist participant 2)*

5.4.2.12 Adopting a problem solving approach

The importance of adopting a problem solving approach to help the patient with exercise adherence was outlined by the physiotherapists. The patient representatives also discussed how it feels when this problem solving approach doesn't take place, and it can feel that they haven't been assessed holistically.

> *…so if people come back to me and say that they're struggling, we'll sit down and kind of write things down, why are you struggling and that's had a positive impact with certain patients who've said its really useful to sit down and actually work out a time when I can do*

my exercises, how can I fit it into my day and writing it down, rather than just having a verbal conversation (Interview physiotherapist participant 9)

…just figuring out what it is that is limiting them and if it's about the exercise then changing it and if its more about the circumstances then trying to figure out 'okay is this important enough for them to want to focus on this and put their time and energy into (Interview physiotherapist participant 3)

…so I think it's just having those discussions really about what they feel is going to motivate and some people want pushing, want hand holding with their exercises like in the gym with physios, or they will want to go home and do it on their own. (Focus group physiotherapist participant 4)

Yeah, I've never been asked that, like how do you manage your condition with your lifestyle, they never look at the holistic approach. (Focus group participant 1, ankylosing spondylitis patient, 66 years old)

5.4.2.13 Round two

In Round Two of this project, participants were asked to refine a draft intervention that had been developed, in part, from the information gathered in Round One. This is described further in step 4, section 5.7 where producing and refining the programme components and materials is discussed.

5.4.2.14 Limitations of the qualitative work

The reasons for approaching those with AS have been outlined earlier in this chapter. Primarily it was because they belonged to a local NASS branch and have maintained an exercise programme over long periods of time. However, it would have been useful to also have had a group that could be considered less adherent to exercise programmes. This would have given the added value of hearing from those who appear to succeed in maintaining exercise programmes and those who struggle to do so. This combination could have provided more comprehensive data to feed into the development of the intervention.

In addition, using a focus group for physiotherapists meant that it was only really accessible for those working locally and additional measures could have been used to gather views from further afield. Also, as outlined in chapter 4 seeking the views of physiotherapy assistants and technical instructors may have been beneficial and improved the representativeness of the sample. However, views were sought from physiotherapists of different ages, and years of experience.

5.4.2.15 Impact of the qualitative work

The qualitative work allowed for the expression of views of physiotherapists and patient representatives related to the development of an exercise adherence intervention. The views outlined were taken into the subsequent steps of the development process. In particular it was clear from this work that an intervention would need to be flexible enough to deal with individuals with different needs and motivations. In addition, the importance of considering issues that would help to incorporate behaviour change approaches into clinical practice were highlighted, such as the intervention being timely, and training being provided.

5.4.3 Step 1 summary

Step 1 of the intervention mapping process involved gathering information on the factors that can affect exercise adherence in older adults with MSK conditions. This information was gathered mainly via two sources, relevant literature and the views of relevant stakeholders gathered in a qualitative study. The literature in addition to the interviews and focus groups highlight a number of variables that could influence adherence to exercise in older people (see section 5.4.3.1). This information was used in step 2 of the process (5.5).

In the intervention mapping process, planners of health promotion programmes are encouraged to think about the different aspects of the problem. These include:

1. Personal determinants of behaviour
2. Environmental factors
3. Behavioural factors
4. Health outcomes and quality of life (Bartholomew Eldredge et al 2016)

5.4.3.1 Personal determinants

Personal determinants relate to factors existing at the individual level that affect the behaviour in question. For the intervention design these have been considered for older people with MSK conditions, the population of interest, and for physiotherapists who prescribe exercise programmes, and are therefore important agents acting in the environment where exercise programmes are prescribed. A number of the variables described relate to the person and could be considered as personal determinants of the patient. Some of these are non-modifiable, or not easily modifiable such as socioeconomic level, education level, marital status, or having a pacemaker. Whereas other determinants are more modifiable, such as self-efficacy, motivation, understanding or knowledge about exercise, and physical ability. Within the intervention mapping approach it is the modifiable factors that an intervention might change that are considered personal determinants. Therefore it is these more modifiable factors that are used in the next steps of the process. Some of the factors outlined relate more to the physiotherapists prescribing the exercise programmes, for example their knowledge and skill in facilitating behaviour change. These variables are categorised in the personal determinants related to the physiotherapists and others in the logic model, which is outlined in step 2.

5.4.3.2 Environmental factors

Environmental factors are aspects of the environment that have the potential to influence the behaviour under consideration. These could be considered in various subcategories including 1) Interpersonal, related to those in close contact with the population in question; 2) Organisational, related to structures that have specific objectives, such as a hospital, or a hospital department. 3) Community, representing systems which may or may not have physical boundaries where people are joined in social networks; 4) Societies, which are large systems which may influence many parts of the life of those within the system. For this project the main consideration was on the interpersonal and organisational aspects of the environment, with the focus directed to the interaction between patients and physiotherapists, and on the department where the physiotherapists work. Potentially important factors could be considered from an interpersonal perspective, such as limited time for discussion of the proposed approaches to help facilitate adherence to exercise, or from an

organisational point of view such as related training or behaviour change being considered as part of routine practice.

5.4.3.3 Behavioural factors

For this section, the behaviour that was influenced by the personal determinants and environmental factors was outlined. In this case, they could result in poor adherence behaviour, with patients demonstrating partial or non-adherence to prescribed exercise programmes. This could be due to a number of reasons, such as choosing not to complete the exercise, forgetting, or not finding time.

5.4.3.4 Health outcomes and quality of life

Finally, consideration was given to health outcomes and quality of life. It is known that exercise is a commonly used and effective treatment modality across a range of MSK conditions (Artz et al 2013, Grieve and Palmer 2016, Hoffmann et al 2016, Palmer et al 2015, Rushton et al 2014, Smith et al 2011). Therefore partial or non-adherence to prescribed exercise programmes has the potential to maintain or increase the burden of MSK conditions, including pain, disability, limited mobility and depression (Arthritis Research UK 2018).

5.5 Step 2 - Intervention Mapping: Programme objectives

In step 2 the programme objectives were created, these included a behavioural outcome and an environmental outcome, in addition to considering where the best place to target these outcomes would be. Performance objectives were identified for both the behavioural and environmental objective, change objectives were created by considering the performance objective and personal determinants related to exercise adherence. These were outlined in matrices for change, for both behavioural and environmental objectives. Finally a logic model of the intervention was constructed (figure 5.2).

5.5.1 Programme objectives

Programme objectives were divided between behavioural outcomes, those that related to the people undertaking the behaviour of interest, and environmental outcomes, those that are related to environmental agents, such as physiotherapists.

The behavioural outcome was:

- Older people with MSK conditions will adhere to their exercise programmes as agreed between the physiotherapist and themselves

The environmental outcomes were considered at two levels, the first the interpersonal level:

- Physiotherapists support older people with MSK conditions to adhere to their exercise programme

The second was at the organisational level:

- Physiotherapists offer exercise adherence strategies that are relevant for individual patients

5.5.2 Target area for intervention

It is clear from step 1 that there are numerous factors with the potential to affect exercise adherence, and that these can be considered to occur in different contexts, e.g. personal determinants or environmental factors (Bartholomew Eldredge et al 2016). The main focus or targets for this study were the environmental factors, both interpersonal and organisational, as identified in step 1. By targeting the environmental factors, it was considered that this could also have an effect on the personal determinants of exercise adherence.

There were a number of reasons for this decision. It targets the time when physiotherapists and patients are together allowing an intervention to be targeted to the individual patient, based on the physiotherapist's assessment. It is a time when the healthcare professional is gathering information from the patient as part of routine care and where additional information could be collected without causing an excessive burden on either party. Secondly, physiotherapists are in an ideal position to assess and deliver an exercise adherence intervention. They routinely assess patients in order to prescribe an exercise programme and can add strategies or approaches to facilitate better adherence making it practicable to use in clinical practice.

5.5.3 Performance objectives

The performance objectives are the tasks needing to be achieved to fulfill the programme objectives. They focus on both older people with MSK conditions and physiotherapists and relate to either the behavioural or the environmental programme objectives.

Behavioural outcome: Older people with MSK conditions will adhere to their exercise programmes as agreed between the physiotherapist and themselves.

Related performance objectives for behavioural outcome: Older adults with MSK conditions will…

- Decide to undertake their exercise programme
- Monitor their exercise undertaken
- Maintain their exercise behaviour

Environmental outcomes: Physiotherapists support older people with MSK conditions to adhere to their exercise programme, and they will offer exercise adherence strategies that are relevant for individual patients.

Related performance objectives for environmental outcomes: Physiotherapists will…

- Facilitate exercise adherence in older adults
- Assess older adults in relation to exercise adherence
- Recommend appropriate adherence strategies for the individual patient
- Undergo appropriate training related to exercise adherence

5.5.4 Change objectives

Change objectives were created by taking the performance objectives discussed above and tabulating them along with the personal determinants reviewed in step 1. This led to two matrices, considering both the behavioural and environmental performance objectives (tables 5.2 and 5.3). Finally, all the points described in this step are included in a logic model for the intervention (figure 5.2).

5.5.5 Step 2 summary

In step two a target area for the future intervention was chosen. Following this, performance and change objectives were created. Step three considered how best to meet these objectives and theoretical and practical approaches for the intervention were selected.

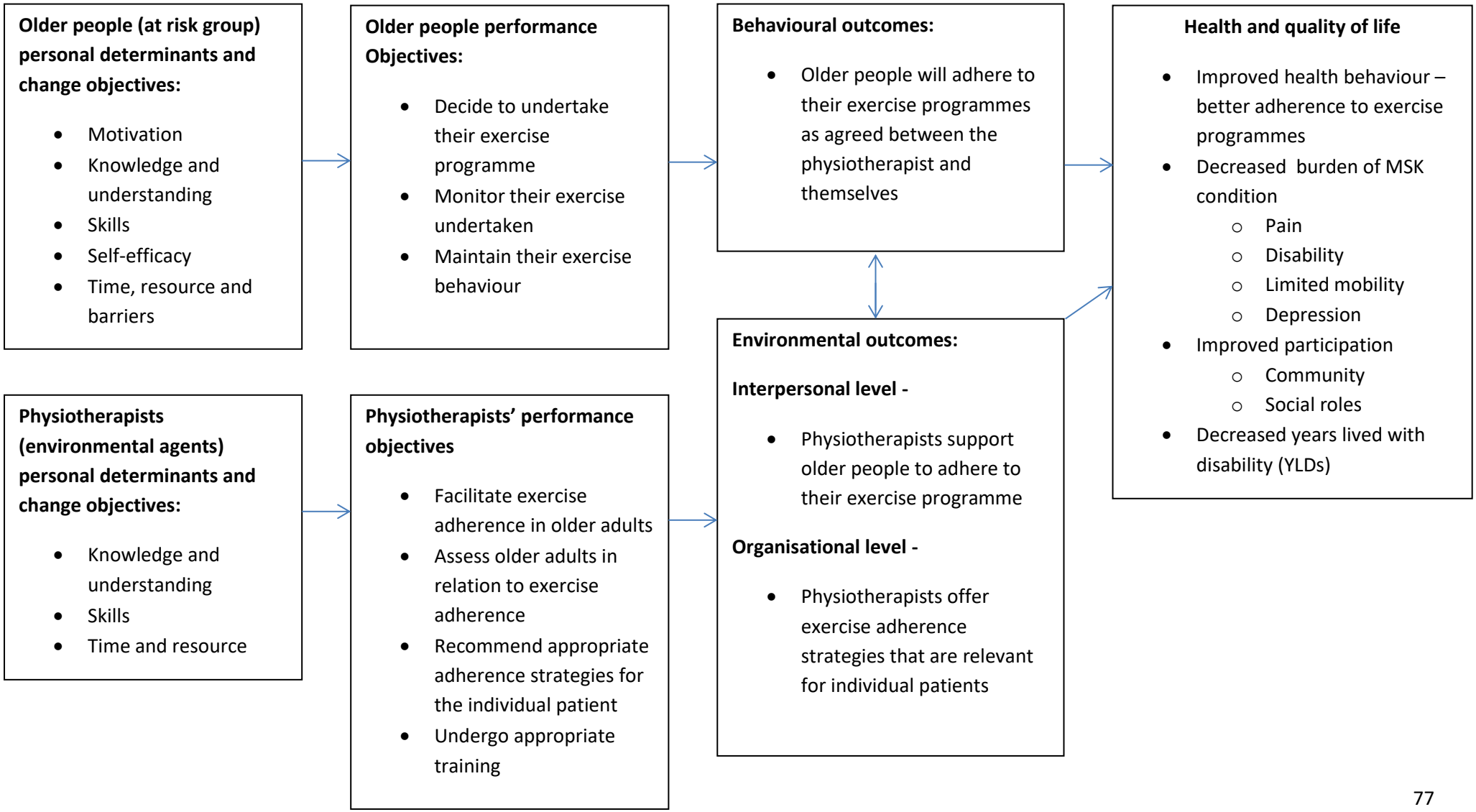
Table 5.2 Change Objectives for the Behavioural Performance Objectives

Performance objectives (behavioural) Older adults will…	Personal determinants				
	Motivation	**Knowledge and understanding**	**Skills**	**Self-efficacy**	**Time, resource and barriers**
Decide to undertake their exercise programme	M1. Describe why exercise will help achieve personal goal(s) M2. Commit to undertaking exercise programme	K1. Restate what their exercise programme consists of	S1.Possess the physical and psychological skills to undertake exercise programme S2. Possess the ability to problem solve, to overcome barriers, and/or make use of facilitators	SE1. Feel confident in ability to undertake exercise programme	T1.Plan to undertake exercise at appropriate time and place T2. Make sure any equipment needed is available
Monitor their exercise undertaken	M3. Commit to recording completed exercise	K2. Understanding how to self-monitor and record exercise undertaken	S3. Possess or learn the skills to record completed exercises	SE2. Feel confident in ability to monitor and record exercise completed.	T3. Use appropriate resources to monitor and record exercise undertaken
Maintain their exercise behaviour	M4. Review goal(s) and how exercise programme will help meet them M5. Commit to continuing with exercise programme	K3. Understand what to do if a relapse has occurred	S4. Use relevant exercise adherence strategies S5. Feedback to physiotherapists if encountering challenges	SE3. Feel confident in ability to continue with exercise programme	T4. Continue to undertake exercise at appropriate time and place

Table 5.3 Change Objectives for the Environmental Performance Objectives

Performance objectives (environment) Physiotherapist will…	Personal determinants		
	Knowledge and understanding	**Skills**	**Time and resource**
Facilitate exercise adherence in older adults	EK1. Recall steps that could facilitate exercise adherence EK2. Understand appropriate exercise adherence strategies	ES1. Identify appropriate strategies to facilitate exercise adherence, e.g. • Encouragement/verbal persuasion • Clear communication and instruction on exercise programme • Facilitate motivation – e.g. motivational interviewing • Demonstrating exercise programme • Facilitate appropriate goal setting • Review performance • Review goals • Facilitate problem solving • Use of cues • Use of behavioural contracts • Use of action plans • Use of decision balance sheet	ET1. Incorporate facilitating exercise adherence into standard physiotherapy session
Assess older adults in relation to exercise adherence	EK3.Recall all crucial aspects of assessment	ES2. Use appropriate resources to aid with assessment ES3. Analyse responses of older adults	ET2.Allow time for assessment ET3. Incorporate assessment into standard physiotherapy session
Recommend appropriate adherence strategies for the individual patient	EK4.Describe potential strategies	ES4. Use appropriate strategies based on assessment outcome	
Undergo appropriate training related to exercise adherence	EK5. Recall time and location of training		

Figure 5.2 Logic Model of Change, based on Bartholomew Eldredge et al (2016)



5.6 Step 3- Intervention Mapping: Theoretical and practical approaches

In step 3 of the intervention mapping process, theoretical and practical approaches were identified. The aim was to consider what theories or approaches would enable the intervention to meet the performance and change objectives in step 2, and to influence or change the determinants identified in step 1. The previous literature offers some suggestions for approaches that have the potential to help in the field of adherence to exercise for older people with MSK conditions. For example the systematic review discussed in chapter 3 (Room et al 2017) identifies that interventions categorised in the feedback and monitoring categories of the BCTTv1 (Michie et al 2013) showed positive results in facilitating improved exercise adherence. However, the review also recognised the lack of theoretical underpinning of many interventions trialled in RCTs and step 1 showed that the potential determinants affecting exercise adherence are numerous. In addition to this the views of relevant stakeholders in step 1 emphasised the need to be able to tailor any intervention to the individual. These factors identified the need for an intervention and its subsequent components to be theoretically underpinned and tailored to the individual participant. Several approaches feed into the design of this intervention, these included the MRC's guidance for developing complex interventions (Craig, Dieppe, Macintyre, Mitchie, et al 2008), , the therapeutic alliance literature, the BCW - specifically the COM-B system (Michie et al 2011), and the BCTTv1 (Michie et al 2013). These are outlined below.

5.6.1 Medical Research Council's guidance for developing complex interventions

The MRC guidance includes pertinent information on developing and assessing complex interventions with several steps recommended in the development stage. These include identifying existing evidence, and identifying and developing theories. The relevant literature in the field of exercise adherence has already been identified and discussed in step 1. In the following sections of chapter 5 the relevant theories will be discussed.

5.6.2 Therapeutic alliance

Chapter 4 highlighted physiotherapists' perception of how adherence and non-adherence to exercise programmes affects their practice, and one of the important factors discussed was establishing good working relationships with patients. This was also featured in step 1 of the intervention mapping process, as part of the qualitative study (section 5.4.2). Here, being able to tailor treatments to the individual, which requires knowledge about what is important to them, was seen as crucial. This relationship, also known as the therapeutic alliance has been researched more extensively in medicine and psychotherapy (Hall et al 2010), where it has been reported that the therapeutic relationship can have a positive association with treatment adherence, alongside satisfaction and quality of life (Bennett et al 2011). Although studied less extensively in other areas of practice, there is evidence to suggest the therapeutic alliance could be a useful consideration for an exercise adherence intervention. Hall et al (2010) conducted a systematic review on the therapist-patient relationship and its influence on treatment outcome in physical rehabilitation. They reported that the therapeutic relationship seems to have a positive effect on outcomes, including treatment adherence for some of the conditions studied. This is in line with a scoping review looking at the characteristics of the therapeutic relationship in MSK physiotherapy and occupational therapy practice (Babatunde et al 2017), which described exercise adherence as one of the potential benefits of improving the therapeutic alliance. As such, much consideration was given

to the patient-therapist relationship when designing the AERO intervention. Here physiotherapists were encouraged to work collaboratively with their patients and use the intervention described in the next step, to help facilitate behaviour change, rather than imposing change, or any of the intervention components upon them.

5.6.3 The COM-B model

Whilst having a course of physiotherapy treatment patients are asked to adopt and stick to an exercise programme. They are being asked to do something they were not doing previously, therefore they are being asked to change their behaviour. Step 3 considers appropriate behaviour change theory to inform the intervention development. There are many behaviour change models in existence (Michie et al 2014), and in addition to considering the information described above, it was also important to use a theory that was accessible to physiotherapists who may not have an in-depth understanding of behaviour change.

The BCW (figure 5.3) is a framework for designing and evaluating behaviour change interventions (Michie et al 2011). It consists of three parts, the centre in green represents the sources of behaviour, the next ring out in red represents intervention functions and the outer ring in grey represents policy categories. At its centre, the green circle representing sources of behaviour is the COM-B system (Michie et al 2014). The premise of COM-B is that in order for any behaviour to take place there needs to be the capability, opportunity, and motivation. Each of these categories can be subdivided into two subcategories; these are outlined below along with their definitions (table 5.4).

Figure 5.3 The Behaviour Change Wheel with the COM-B system (Michie et al 2014)

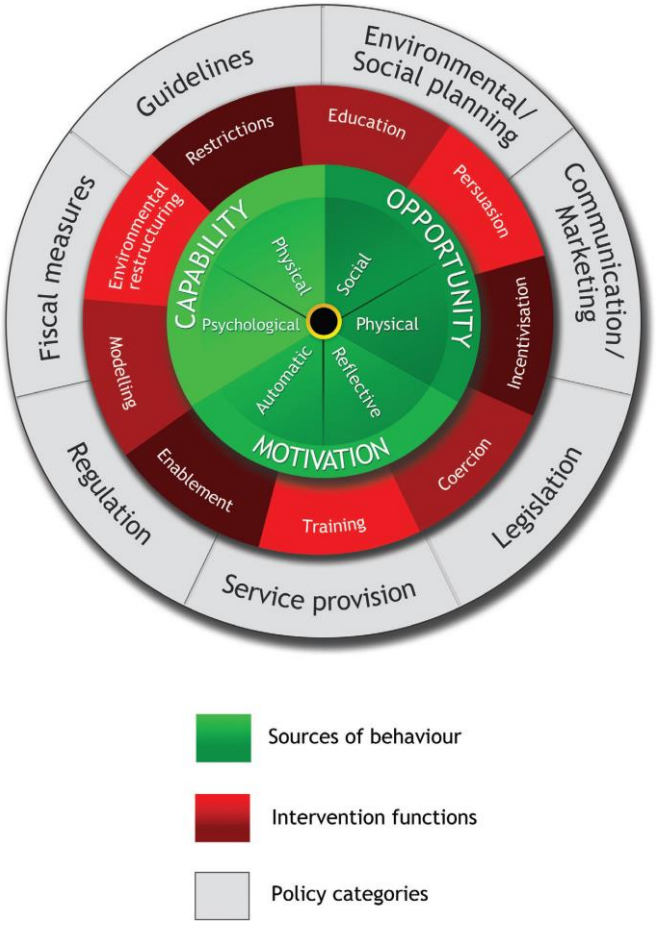


Table 5.4 Capability, Opportunity and Motivation as defined in the COM-B system (Michie et al 2014)

Category	Definition	Sub-category	Definition
Capability	*The individual's psychological and physical capacity to engage in the activity concerned. It includes having the necessary knowledge and skills*	**Physical Capability**	*Having the physical skills, strength or stamina to perform the behaviour*
		Psychological Capability	*Having the knowledge, psychological skills, strength or stamina to perform the behaviour*
Opportunity	*All the factors that lie outside the individual that make the behaviour possible or prompt it*	**Physical Opportunity**	*What the environment allows or facilitates in terms of time, triggers, resources, locations, physical barriers, etc.*
		Social Opportunity	*That afforded by the cultural milieu that dictates the way that we think about things (including interpersonal influences, social cues and cultural norms)*
Motivation	*All those brain processes that energise and direct behaviour, not just goals and conscious decision-making. It includes habitual processes, emotional responding, as well as analytical decision-making*	**Automatic Motivation**	*processes involving wants and needs, desires, impulses and reflex responses*
		Reflective Motivation	*Involving self-conscious planning and evaluations (beliefs about what is good or bad)*

One of the aspects of the BCW framework is the understanding that a specific behaviour occurs in a specific context. For one person, capability may be the only target to consider. However for others it may be that changes to capability, motivation and opportunity are all required (Michie et al 2014). The COM-B system could therefore be used as the basis to design a behavioural assessment forming

part of the intervention. This could enable physiotherapists to assess patients' capability, opportunity and motivation and to target exercise adherence strategies based on this.

5.6.4 Behaviour Change Technique Taxonomy version 1

The BCTTv1 is a classification of distinct BCTs (Michie et al 2013), it attempts to distil and categorise the active ingredients of behaviour change interventions. The taxonomy consists of 16 categories, each populated with associated BCTs. The full list of these BCTs can be seen in appendix 2. The taxonomy was used to consider potential exercise adherence strategies that would be appropriate and practical to use with an intervention taking place during a physiotherapy appointment.

5.6.5 Behaviour change techniques included in the AERO intervention

The BCTTv1 includes 93 distinct BCTs. Clearly it would not be necessary, useful, or pragmatic to include all BCTs in any intervention. Table 5.5 outlines the BCTs chosen for the AERO intervention, along with a description of each, the reason they were selected, the domain of COM-B that they target and the theorised outcome of using them. How they were packaged and practically delivered is covered in step 4 along with evidence to justify their use.

5.6.6 Critique of the Behaviour Change Wheel, COM-B and the Behaviour Change Technique Taxonomy Version 1

Critique of COM-B and more widely the Behaviour Change Wheel (Michie et al 2011) and BCTTv1 (Michie et al 2013) has focused on two main points. The first made by Ogden (2016) is that COM-B may be an over systemisation and that variability in theory and people is something to be regarded rather than removed. The second made by Kok et al (2016) is that as a taxonomy all behaviour change techniques are categorised and described but are not measured for effectiveness. This could mean that within the taxonomy there may be effective and ineffective approaches. The theory was however still relevant to use for this project despite these potential limitations. On the first point, the systematisation is something which is helpful for those such as physiotherapists, who are not psychologists. Handling variability in theory may be easier for those practicing day to day in the area of psychology, but it is potentially much more challenging for those who might not have the same level of understanding. On the second point, as can be seen in step 4 (Section 5.6.1.2.2), the approaches considered for the intervention were done so on the basis of their use in the literature to date and not just as standalone BCTs.

5.6.7 Step 3 summary

Step 3 considered the practical approaches and theory relevant to intervention development. This led to an intervention underpinned by the COM-B system and was produced with use of the BCTTv1. It is apparent that a number of factors have informed the development of the AERO intervention and these have been outlined in steps 1, 2 and 3 (figure 5.4.)

Figure 5.4 The different components that informed the development of the AERO intervention

Table 5.5 BCTs Selected for the AERO Intervention

Behaviour Change Techniques	Category in the Behaviour Change Taxonomy	Description	COM-B domain target	Reason selected	Change objective targeted	Theorised outcome
Goal setting (behaviour)	Goals and Planning	A goal agreed in relation to a behaviour	Motivation	to help motivation with initiation of programme to help motivation to maintain programme to give a reason to perform the exercise programme	M1, M2, S4	Increased motivation to undertake exercise programme Increased commitment to undertake exercise programme
Problem solving	Goals and Planning	Considering factors that influence the behaviour, the barriers and facilitators, and make steps to decrease barriers and increase facilitators. Note – this includes relapse prevention and coping plans	Opportunity	enable people to overcome barriers enable people to use facilitators	S2, S4, S5	More likely to start exercise programme More likely to continue exercise programme
Goal setting (outcomes)	Goals and Planning	A goal agreed in relation to outcome	Motivation	to help motivation with initiation of programme to help motivation to maintain programme to give a reason to perform the exercise programme	M1, M2, S4	Increased motivation to undertake exercise programme Increased commitment to undertake exercise programme
Action planning	Goals and Planning	Encourage plan for performance of the behaviour	Opportunity	To help consider what steps might be needed to undertake exercise programme	M5, K1, S2, T1, T2, T4	People more likely to initiate or maintain exercise programme due to appropriate planning
Review behaviour goal(s)	Goals and Planning	A review of the behaviour goal	Motivation	to help motivation with initiation of programme	M1, M2, M5, S4	Increased motivation to undertake exercise programme

				to help motivation to maintain programme to give a reason to perform the exercise programme		Increased commitment to undertake exercise programme
Review outcome goal(s)	Goals and Planning	A review of the outcome goal	Motivation	to help motivation with initiation of programme to help motivation to maintain programme to give a reason to perform the exercise programme	M1, M2, M5, S4	Increased motivation to undertake exercise programme Increased commitment to undertake exercise programme
Behavioural contract	Goals and Planning	A written agreement of the behaviour to be performed	Motivation	To encourage people to commit to their exercise programme To encourage people to commit to when, where and how they will undertake their exercise	M2, S4, T1, T2, T4	Increased commitment to initiating and undertaking exercise programme
Self-monitoring of behaviour	Feedback and monitoring	Create a method to allow people to monitor and record behaviour	Motivation	Allow people to monitor and record their own progress To be able to look back and see what they have already achieved	M3, K2, S3, S4, SE2, T3,	Participants able to self-monitor exercise undertaken, potentially enabling the identification of any barriers or problems earlier, and potentially increasing motivation by demonstrating what has been undertaken previously
Feedback on behaviour	Feedback and monitoring	Provide feedback on the behaviour	Capability Motivation	To enable physiotherapists to provide feedback to help either encourage if going well, and therefore potentially also use verbal persuasion, or to help problem solve if required	M4, K3, S4 SE1, SE3	Potential to encourage participants if things are going well Potential to problem solve and create steps to manage exercise programme if things are not going well
Instruction on how to perform the behaviour	Shaping Knowledge	Give information on how to perform the behaviour	Capability	To allow physiotherapists to offer instruction on how to perform the exercises within a	K1, S1, S4, SE1, SE3	Participants more likely to be able to undertake exercise programme

				programme, and to offer appropriate ways to give the instructions to participants		that has been instructed in an appropriate way
Demonstration of behaviour	Comparison of behaviour	Offer an observable demonstration of the behaviour	Capability	To allow physiotherapist to demonstrate the required exercises to participants in order that they can complete them appropriately	K1, S1, SE1, SE3	Participants more likely to be able to undertake exercise programme that has been demonstrated
Prompts /cues	Associations	Add a stimulus to the environment to prompt or cue the behaviour	Opportunity	To enable participants' exercise programmes to be prompted by an appropriate cue	S4, T4	Potentially improved exercise adherence if participants are cued to do it
Comparative imagining of future outcomes	Comparison of outcomes	Considering the outcomes of changing versus not changing behaviour	Motivation	To help weigh up the pros and cons of both undertaking the exercise programme, or not	M2, M5,	Potentially improved initiation of exercise by considering potential future if exercise programme is or is not undertaken
Verbal persuasion about capacity	Self-belief	Tell a person that they can undertake the behaviour successfully	Capability Motivation	To allow physiotherapists to offer verbal persuasion that participant is completing the exercises as planned, or could undertake exercises as planned	S1, SE1, SE3, S4,	Potentially improved self-efficacy and therefore exercise adherence if people receive verbal persuasion
Self-talk	Self-belief	Encouraging positive talk from a person	Motivation	To facilitate the participant to talk positively about the behaviour or their ability to undertake it	M2, M5, SE1, SE3,	Potentially improved self-efficacy and therefore exercise adherence if people use positive self-talk

5.7 Step 4- Intervention Mapping: Producing and refining the programme components and materials

Step 4 describes how a draft version of the AERO intervention was produced and refined prior to feasibility testing. The intervention and its various components are detailed below, in addition to outlining why each component was considered a necessary part of the intervention.

5.7.1 The intervention

5.7.1.1 Intervention overview

The intervention consisted of a brief behavioural assessment informed by COM-B (Michie et al 2011) that was conducted as part of the participants physiotherapy assessment. It included recommended exercise adherence strategies tailored to the individual patient, based on the outcome of the assessment.

5.7.1.2 Intervention components

5.7.1.2.1 Assessment

Assessment was the first aspect of the intervention. This consisted of two parts. In part 1 participants were asked to answer four short questions whilst sitting in the waiting room prior to their physiotherapy appointment. The pre-physiotherapy questions were:

1. Do you undertake any exercise currently?
2. If yes, what exercise is this, and where does it take place?
3. What goals are you hoping to achieve by coming to physiotherapy today?
4. What are your hobbies, what is important to you?

These questions were there to help the physiotherapist understand the participant a little better from the outset. This information may be helpful to consider when setting up an exercise programme to link it to the participant's current exercise habits, their goals and hobbies. These questions were mainly draw from the qualitative work outlined in step 1 (section 5.4.2), and in particular the themes 'Need to tailor to the individual' and 'Adopting a problem solving approach' where physiotherapists described the importance of understanding a bit more about the individual, where they were coming from, and what might motivate them.9ol

In part 2 participants were then routinely assessed and given an exercise programme as is standard practice in physiotherapy. Following this they were asked to answer a further seven questions. These were:

1. Do you feel you have the necessary capacity (e.g. strength, flexibility, fitness, etc.) to undertake your exercise programme?
   Score on a scale 0-10 where 0 is 'I definitely don't have capacity', to 10: 'I definitely do have the capacity'.
2. What way would you like to have information about your exercises presented e.g. written down, a picture or drawing or a video on your phone?
3. How do you normally remember important things like an appointment?

4. Are there any barriers, or things that could get in the way of you doing your exercise programme?
5. How confident do you feel that you can undertake your exercise programme? (i.e. do you feel you have the time and any equipment that you might need etc.)
   Score on a scale of 0-10, where 0 is not confident at all, and 10 is totally confident.
6. How motivated do you feel to undertake your exercise programme on a scale of 0-10? Where 0 is completely unmotivated and 10 is completely motivated.
7. Is it clear to you how the exercise programme will help you achieve your goals?

These questions were drawn from considering the types of questions used in the BCW (Michie et al 2014), and thinking about which questions would help to assess where someone was sitting in the capability, opportunity, and motivation domains of COM-B. Answers to these questions were reviewed by the physiotherapist and if needed further discussion between the participant and the physiotherapist took place. The physiotherapists then made an assessment on the participants capability, opportunity and motivation.

They were asked to rate each area in the following way:

- High meaning little need to target
- Adequate meaning may be useful to target but not essential
- Low meaning an area that we should consider targeting

Physiotherapists were reminded that there was no 'right' or 'wrong' answer to this, but it could be viewed as an opportunity to collaborate with patients to facilitate better adherence to exercise.

The following suggestions were given to physiotherapists to help them rate each category.

Capability

'Based on the answer to post-exercise question 1, and your discussion, would you score the participant as 'low', 'adequate' or 'high' for capability? Consider a score of 0-4 as low, 5-7 as adequate, 8-10 as high'.

Opportunity

'Based on the answers to post-exercise questions 4 and 5, and on your assessment and discussion with the participant, would you score the participant as 'low', 'adequate' or 'high' for opportunity? Consider 'low' if the participant scores 0-4 for question 5, and/or if the participant reports significant barriers in question 4. Consider 'adequate' if the participant scores 5-7 in question 5, and/or the participant reports barriers which you feel are not insurmountable. Consider 'high' if the participant scores 8-10 in question 5 and/or lists no or minimal barriers in question 4'.

Motivation

'Based on the answers to post-exercise questions 6 and 7 and on your assessment and discussion with the participant, would you score the participant as 'low', 'adequate' or 'high'? Consider 'low' if the participant scores 0-4 on questions 6 and/or if the participant answers 'no' to question 7.

Consider 'adequate' if the participant scores 5-7 on question 6, and/or answers 'not sure' on question 7. Consider 'high' if the participant scores 8-10 on question 6 and 'yes' on question 7'.

5.7.1.2.2 Exercise adherence strategies

On the basis of the assessment, physiotherapists then suggested one or more adherence strategies, and the area that they felt it would be beneficial to target. These are outlined in table 5.6.

Table 5.6 Exercise adherence strategies included in the intervention and how they relate to the domains in the COM-B system

Relating to Capability	Relating to Opportunity	Relating to Motivation
• Review of exercise programme • Review method of delivery	• Cues • Reminders • Discussion of barriers, problem solving and action plan	• Motivational Interviewing • Decision balance sheets • Behavioural contract • Goal setting review • Monitoring call

The different exercise adherence strategies available to physiotherapists in the AERO intervention are outlined below. The strategies included packages of the BCTs described in table 5.5. The strategies considered were drawn from the previous literature relevant to physiotherapy and exercise prescription. A description and justification, including its use in previous research, for each approach is given along with the specific BCTs it encompassed alongside the number that the BCT was allocated in the BCTTv1 (Michie et al 2013). The complete list of these BCTs can be seen in appendix 2.

Review of exercise programme

This strategy involved making sure participants could complete the exercises they have been asked to do, and then offering encouragement. This kind of feedback, reinforcing that the participant can achieve the desired behaviour has long been suggested (Sluijs and Knibbe 1991). It is also known that two of the factors that can affect self-efficacy are performance outcome, such as correctly mastering performance of an exercise, and verbal feedback (Bandura 1977). With this approach physiotherapists can offer a review of the prescribed exercise programme including a demonstration of how they should be performed. Participants were then observed performing each exercise for all sets and repetitions, in order to check they had the required capacity to complete the programme. This could result in the programme being modified or verbal encouragement was given to the participant if it was felt they had the necessary capability. The BCTs included in this strategy were;

- 2.2 Feedback on behaviour
- 4.1 Instruction on how to perform the behaviour
- 6.1 Demonstration of the behaviour
- 15.1 Verbal persuasion about capability

Review of method of delivery

The way participants are given information about their exercise programmes may be an important factor. The mode of exercise instruction has been tested in participants with OA, although no difference in adherence was found with various types of exercise information (Schoo et al 2005). Lin et al (1997) found a difference using mediums such as video to give information and Smith et al (2005) found that provision of an exercise sheet to elderly patients may not be sufficient to help them remember their exercise programme. With this approach the aim was to give exercise instructions tailored to the individual. For example some may request them written down, some may prefer illustrations, and some may want a video on their phone. The BCT included in this strategy was;

- 4.1 Instruction on how to perform the behaviour

Cues

The aim of this strategy was to introduce a stimulus that cued the participant to remember their exercise programme. Cues have been described as a useful and effective strategy for adherence to health behaviour such as medication adherence (Stawarz et al 2016). Cue cards have also been used in previous physiotherapy exercise research (Bassett and Prapavessis 2007). In this strategy physiotherapists were encouraged to discuss with participants what cues might work for them personally. By considering where they are likely to be or what they are likely to be doing when they need to do their exercise programme, they could design a cue that could be introduced to those specific locations or activities. The BCT included in this strategy was;

- 7.1 Prompts/cues

Reminders

Similar to cues, for some participants it may be useful to have a reminder to undertake their exercise programme. The physiotherapist was advised to consider what would work for the individual participant. Examples could include diary entries or alarms on a phone. The BCT included in this strategy was;

- 7.1 Prompts/cues

Discussion of barriers, problems solving and action plan

In addition to exercise (Sniehotta et al 2005), action and coping plans have been demonstrated to have an effect on physical activity (Ziegelmann et al 2006), and have been used in a physiotherapy feasibility study looking at exercise adherence in those with lower limb OA (O'Brien et al 2013). With this approach physiotherapists discussed the barriers that participants felt had the potential to stop them exercising. The discussion was focused on suggesting potential steps to overcome these barriers, or helping participants to come up with their own solutions. To help this process an action plan (appendix 9) was available which identified potential barriers and steps to overcome, which were documented. In addition to considering how to manage a relapse, physiotherapists were

advised to encourage “something being better than nothing”, and if a day is missed, they should just reset and start again the next day. The BCTs included in this approach were;

- 1.2 Problems solving
- 1.4 Action planning
- 9.3 Comparative imagining of future outcomes
- 15.1 Verbal Persuasion about capability

Motivational interviewing

Motivational interviewing is a client-centred counselling approach to facilitate behaviour change by helping people to resolve ambivalence (Rollnick and Miller 1995), and has been reported to be effective in domains such as exercise behaviour (Martins and McNeil 2009). If physiotherapists felt a motivational interviewing approach would be helpful then they were advised to consider eliciting change talk in the participants, rather than trying to impose change upon them. The BCTs included in this strategy were;

- 9.3 Comparative imaging of future outcomes
- 15.4 self-talk

Decision balance sheets

Decision balance sheets have the potential to facilitate behaviour change (Geller et al 2012), and may be a useful strategy to change exercise behaviour (Prestwich et al 2003), and improve exercise adherence (Bassett 2015). For this approach physiotherapists had the option to ask participants to fill in a decision balance sheet (appendix 10). This involved thinking about what may happen if they did or did not undertake their exercise programme. This could also be linked to their goals. The BCT included in this strategy was;

- 9.3 Comparative imaging of future outcomes

Behavioural contract

There is some evidence to support the use of behavioural contracts in improving exercise adherence (Williams et al 2005), or as part of a wider behavioural exercise adherence programme (Azizan et al 2013). When using a behavioural contract (appendix 11) participants wrote down when and where they would undertake their exercise programme and if there was anyone who could help them with it; this could then be signed by the participant and the physiotherapist. The BCT included in this strategy was;

- 1.8 Behavioural contract

Goal setting review

There is limited evidence to suggest that goal setting can affect adherence to rehabilitation regimes (Levack et al 2006). When they are used it may be important to consider the types of goals that are set (Wilson and Brookfield 2009), and that they should be set collaboratively rather than

physiotherapy mandated (Bassett and Petrie 1999). Participants will have collaborative goal setting as part of standard physiotherapy but with this strategy they were reviewed and then linked to their exercise programme. The aim was to make it clear how the exercise programme would help achieve each specific goal important to them and how each exercise feeds into achieving that goal. Goals could then be changed if required (appendix 12). The BCTs included in this strategy were;

- 1.1 Goal setting (behaviour)
- 1.3 Goal setting (outcome)
- 1.5 Review behaviour goal(s)
- 1.7 Review outcome goal(s)

Monitoring call

A structured telephone call has been demonstrated to improve exercise adherence in older patients after total knee arthroplasty (Chen et al 2016). Also it has been suggested that interventions within the BCTTv1 feedback and monitoring category demonstrated a positive effect on exercise adherence in older adults (Room et al 2017). A monitoring call to the participant could be arranged which offered them the chance to feedback on how things were going. In addition, the physiotherapist could offer them encouragement or help with problem solving for any difficulties that had occurred. The BCTs included in this strategy were;

- 1.2 Problems solving
- 2.2 Feedback on behaviour
- 15.1 Verbal persuasion about capability

Monitoring of exercise

Diaries can be used to measure adherence, although this method may over-estimate any exercise undertaken (Nicolson et al 2018). It may be that they are valid for group level data, but lack validity for individual level data (Frost et al 2016). In addition, an exercise diary may in itself improve adherence (Moseley 2006). Also, as described in the previous strategy it has been proposed that interventions within the BCTTv1 feedback and monitoring category may have a positive effect on exercise adherence in older adults (Room et al 2017). Participants were given an exercise diary to record and monitor the adherence to their exercise programme (appendix 13). The BCT included in this strategy was;

- 2.3 Self-monitoring of behaviour

Refining of intervention materials

A draft version of the intervention was given to ten of the qualitative study participants (section 5.4.2) discussed in step 1 (section 5.4). They were asked to review it and report whether they would keep or remove any components as well as suggesting any changes to the wording or presentation of the materials. On the basis of these suggestions, in order to make sure it was clear and accessible, changes were made to the language used in the materials. There were no recommendations to remove any aspects of the intervention.

5.7.2 Step 4 summary

Step 4 outlines the AERO intervention with its specific components. This intervention will be piloted in step 5 and evaluated in step 6.

5.8 Step 5- Intervention Mapping: Adoption and implementation

In step 5 there was a planned implementation of the AERO intervention. It was piloted in one UK physiotherapy department as part of a feasibility RCT. Considerations relevant to adoption and implementation included recruitment, randomisation, acceptability of the intervention, retention of participants and fidelity along with training for physiotherapists. These points and all aspects of the implementation are covered in full in chapter 6 of this thesis.

5.9 Step 6- Intervention Mapping: Evaluation plan

In the final step, the intervention was analysed as part of a feasibility RCT. This involved reviewing all aspects around the feasibility and relevant outcome measures related to exercise adherence and behavioural regulation. The feasibility study also gathered both quantitative and qualitative data to help in this evaluation, which is covered in chapter 6, where the results are also discussed.

5.10 Conclusion

In this chapter the factors that have influenced the design of the AERO intervention have been discussed along with the steps taken to implement it into clinical practice. The intervention was developed with use of an Intervention Mapping approach, allowing for a stepwise process that enables the consideration of important information, along with the appropriate theory and practical approaches. The AERO intervention was tested in a feasibility RCT that will be described in chapter 6.

6 Individually tailored exercise adherence strategies based on a brief behavioural assessment for older people with musculoskeletal conditions. A feasibility randomised controlled trial

6.1 Summary

The potential problems with sub-optimal adherence and the potential benefits of facilitating improved exercise adherence have been discussed in earlier chapters. The intervention discussed in chapter 5 was tested for feasibility in a feasibility pilot RCT. The methodology and results of this trial are presented in this chapter following the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Eldridge, Chan, et al 2016) (appendix 14).

6.2 Introduction

The rationale for this trial has been presented in the previous chapters of this thesis.

6.2.1 Trial objectives

The objectives of this trial were;

- To determine the feasibility of the AERO intervention and associated study procedures
- To determine the acceptability of the AERO intervention
- To establish if there was the potential for the intervention to improve exercise adherence in older people with MSK conditions

6.3 Methods

6.3.1 Trial design

This was a single blind, feasibility, two arm RCT. It compared one arm of usual care physiotherapy (control group) with a second arm of usual care physiotherapy with the addition of a brief behavioural assessment and individually targeted adherence strategies (intervention group). The objectives of this trial were focused on determining whether the intervention and study procedures could work. This is in line with the aims of a feasibility study (Eldridge et al 2016) and is the reason that this study design was chosen.

The trial included a nested qualitative study where a sub-sample of study patients and physiotherapists were invited to talk about their experience of either usual care or the intervention. This interpretive study used semi-structured interviews to assess the acceptability of the trial, and to explore the patients' experience of trying to adhere to an exercise programme. This embedded study will be discussed in chapter 7.

This trial was registered at ClinicalTrials.gov Ref: NCT03643432

6.3.2 Participants and recruitment

This trial recruited older adults with an MSK condition referred for physiotherapy to an orthopaedic hospital in the South of England. An MSK condition was considered in line with the definition by Versus Arthritis (2019) as *'a broad range of health conditions affecting the bones, joints, muscles and spine'.*

The following inclusion and exclusion criteria were used.

Inclusion criteria

- Participants willing and able to give informed consent; those unwilling or unable could not be included given the ethical and legal obligations to under taking research with human participants (Nijhawan et al 2013) and it was felt that they would be unlikely to be able to follow instructions related to an exercise programme.
- Males or female 65 years or older; the justification for using age 65 is given in section 2.3 and it ensured that participants were older adults which was the focus of the research.
- Referred with a musculoskeletal problem; the intervention was designed for older people with MSK conditions.
- Able to converse and read in English; the study did not have the resources to allow for translators and the participants needed to be able to understand the study paperwork and instructions.

Exclusion criteria

- Any comorbidity that precludes exercising such as unstable angina, or acute illness; involvement in the study required participants to exercise and if this was not possible it would not be ethical or practical to allow them to enter a trial which included exercise.
- Dementia or cognitive impairment precluding the ability to follow an exercise programme; as outlined in section 3.3.4, it was felt that dementia and cognitive impairment are significant areas that could be a topic in their own right, therefore they were beyond the scope of this project.
- Patients referred to physiotherapy for post-surgery rehabilitation i.e. those who had undergone surgery in the last 3 months; post-operatively patients see many different health care professionals, in addition to physiotherapists, who may encourage exercise and so impact on adherence. This could make it difficult to control how much advice participants may get related to exercise.

Recruitment process

Those who met the inclusion criteria were sent an invitation letter, participant' information sheet, reply slip and a free-post envelope along with their physiotherapy appointment letter. If interested, they were asked to contact the PI via the reply slip, or alternatively by email or telephone. Those who responded were given the opportunity to ask any questions and time to consider their participation (a minimum of 24 hours from receiving the study information). Those who agreed to take part where given an appointment where informed consent was taken before baseline. Where possible these appointments were scheduled just prior to the participant's physiotherapy appointment in order to minimise disruption to the participant.

6.3.3 Treatment arms

Usual care

Those randomised to the usual care arm received a routine physiotherapy appointment involving an assessment and treatment, and an exercise programme as decided by the physiotherapist treating the patient. The only difference from standard routine care was that participants were asked to complete an exercise diary for up to 12 weeks recording the exercises that they had undertaken.

AERO intervention

Those randomised to the intervention arm, received usual care physiotherapy with the addition of the AERO intervention. This involved the participant answering four short questions whilst in the waiting room prior to their initial physiotherapy appointment, these questions explored the patients current exercise habits and their aims of coming to physiotherapy. Following this, they underwent a routine physiotherapy assessment and treatment, including the prescription of an exercise programme. Any exercise prescribed to participants in the trial, was at their physiotherapist's discretion. There were no restrictions or specifications. After being prescribed the exercise programme, participants answered a further set of questions exploring their perceived ability, confidence and motivation to be able to undertake their exercise programme. On the basis of the answers to these questions and with further discussion the physiotherapist made an assessment about which domain of COM-B, capability, opportunity, or motivation might be useful to target. In addition they suggested one or more adherence strategies to the participant which could be selected from those listed below:

- Review of exercise programme
- Review of method of delivery
- Cues or prompts
- Discussion of barriers and problem solving including an action plan
- Motivational interviewing
- Decision balance sheets
- Behavioural contract
- Goal setting review
- Monitoring telephone call
- Reminders

These strategies and the AERO intervention are described in detail in chapter 5. The only exception to the steps described above, which although felt to be unlikely, was planned for, was if a participant did not receive an exercise programme as part of their physiotherapy treatment. If this happened they were withdrawn from the study, as it is clearly not possible to encourage, or measure adherence to an exercise programme, that you have not been given. It was envisaged that this would not be a significant problem, as exercise forms such an integral part of physiotherapy treatment (Chartered Society of Physiotherapy 2013a), and therefore the numbers would be negligible, if not zero.

Training

Before the trial began, the physiotherapists delivering the usual care arm received training consisting solely of an overview of the relevant trial paperwork, e.g. exercise diary and treatment log. Those

who delivered the AERO intervention received training which covered: The premise of the COM-B model: The model's definition of capability, opportunity, and motivation: How to use the trial paperwork to make an assessment of these three components: The adherence approaches that could be considered on the basis of the assessment, and how to use them. Throughout the training physiotherapists were encouraged to see the intervention as an opportunity to work collaboratively with participants, rather than seeing it as something which would involve dictating a set approach in an authoritative way. Following the training, time was available for physiotherapists to consider the information and, if necessary, seek clarification from the PI, with at least a week available before they saw a trial participant.

Record of treatment

Physiotherapists completed notes for their physiotherapy treatment as is standard practice, for trial specific information they were asked to complete a treatment log. This included, the date of the appointment, whether or not the participant attended, and specifically for AERO intervention participants the assessment made of the domains of COM-B, and the adherence strategies used in the session.

6.3.4 Outcomes

Feasibility

This study was a feasibility RCT, therefore the aims related to the feasibility of several components of the trial in order to determine whether a larger scale RCT would be possible. The following components were analysed in relation to feasibility.

Recruitment: The number of participants recruited in the allocated window was analysed, in addition to considering the number of participants screened in order to meet the recruitment target. Also, where provided on the reply slip reasons for non-entry into the trial were recorded.

Randomisation: Baseline characteristics for the two arms were reviewed in order to ensure that the method of randomisation had created comparable groups.

Acceptability of the intervention and study procedures: The acceptability of the AERO intervention, and study procedures was explored in qualitative interviews.

Retention of participants: Participant withdrawals, and reason for the withdrawal were analysed.

Fidelity: The PI conducted fidelity checks, observed treatment sessions and checked adherence to the protocol. Fidelity was also analysed.

Additional outcomes

In addition to the feasibility measures outlined above, several outcomes linked to measuring the potential effectiveness of the intervention were also collected. As a feasibility trial, it was underpowered to detect change in the measures described, however these measures will be used to help inform a future adequately powered RCT.

- Demographics: demographic data including age, gender, ethnicity, and the reason for referral to physiotherapy was collected in order to understand the demographics of the sample.

- The Tilburg Frailty Indicator (TFI) (Gobbens et al 2010): This is a self-report measure of frailty, it consists of two sections, detriments of frailty and components of frailty, the latter being divided into physical, psychological and social components. Scores range from 0 – 15, with a higher score being more indicative of frailty, a cut point of 5 is suggested in order to consider an individual as frail. The TFI was only collected on baseline to provide an additional demographic indicator compared to chronological age alone because it is known that chronological age and functional age are distinct (Guralnik and Melzer 2002).

- Physical Activity Scale for the Elderly (PASE) (Washburn and Smith 1993): This is a physical activity self-report questionnaire. The range of the score depends on the amount of work that a participant does, a higher score indicates an individual who is more physically active. As outlined in section 2.1.1 exercise and physical activity are different concepts (Caspersen et al 1985), however, it would be of interest in a full scale RCT to look at the association between physical activity and exercise adherence so PASE was included.

- Self-Efficacy for Exercise Scale (SEE) (Resnick and Jenkins 2000): This self-report scale measures self-efficacy expectations to continue to exercise in the face of barriers to exercise. Scores range from 0-90, with higher scores indicating greater self-efficacy for exercise. Self-efficacy as reported by (Bandura 1977) refers to a person's belief in their ability to perform an activity and achieve a desired goal and has been linked to improved exercise adherence in those with MSK conditions (Nicolson et al 2017). Recording this data will help to determine if the AERO intervention alters self-efficacy in relation to exercise, and if changes in self-efficacy correspond with changes in measured adherence levels which may be of benefit when designing a future RCT.

- Exercise Regulations Questionnaire (BREQ3) (Markland and Tobin 2004, Wilson et al 2006): This self-report questionnaire measures motivation to exercise, it measures forms of intrinsic and extrinsic regulation of exercise behaviour. Results can be presented by giving the scores of the different dimensions of motivation, amotivation, external regulation, introjected regulation, identified regulation, integrated regulation and intrinsic regulation. Each subscale can be scored or presented as the relative autonomy index (RAI), a score derived from all the dimensions. This score can range from -24 to 24 for the BREQ3 version. A higher score indicating greater relative autonomy and a lower score indicating more controlled regulation. Motivation has been linked to exercise engagement in older people (Hill et al 2011), similar to self-efficacy, and it will be of interest to see if motivation changes in response to the AERO intervention, and whether participants move towards more extrinsic motivation. It would also be of interest to see if changes in motivation are associated with changes in exercise adherence.

- EQ-5D-5L (Herdman et al 2011, The Euroqol Group 1990): This self-report questionnaire is a measure of health-related quality of life. EQ-5D-5L enables the generation of an index score ranging from -0.224 to 1, with a higher score indicating a health state closer to full health.

Higher exercise adherence has been associated with improved quality of life scores (Imayama et al 2014) and the EQ-5D-5L was included to explore what happens to its scores in relation to changes in exercise adherence.

- Visual Analogue Scale (VAS): This is a self-rated capacity to exercise, confidence to exercise and motivation to exercise score. Participants were asked to rate their perceived capacity, confidence and motivation to exercise on a scale of 0-10, where 0 is no capacity/confidence/motivation and 10 is maximum capacity/confidence/motivation. The VAS scales were created by the author and have not been validated. They are of interest to determine if an intervention attempting to facilitate better exercise adherence, also leads to an improvement in behavioural regulation, in this case perceived capacity, confidence and motivation to exercise. These three were selected as they roughly mapped the capability, opportunity and motivation domains of COM-B (Michie et al 2011).

- Self-Reported Adherence: This is a self-report scale ranging from 0-10, where patients were asked to rate their adherence over the previous six weeks, ranging from 0 = 'no exercises performed' to 10 = 'all exercise performed as instructed', this scale has been used in previous exercise adherence studies (Bennell et al 2017, Lambert et al 2017). This was one of three adherence measures used to record different aspects of measured exercise adherence and was chosen to see if there was a change in self-reported exercise adherence, based on recall. It will also be possible to see if the different measures correlate with each other.

- Exercise Adherence Rating Scale (EARS): This is a self-report questionnaire, that asks people to record the answer to 6 questions on exercise adherence, on a 5-point Likert scale (Newman-Beinart et al 2016). This is potentially a choice for the primary exercise adherence outcome in a future full scale RCT. The score ranges from 0 to 24, with a higher score indicating better adherence. This outcome measure was included as it is a self-report measure that has been reported to be reliable and valid from initial psychometric evaluation (Newman-Beinart et al 2016), the other measures of exercise adherence could be compared to it.

- Exercise diary: The diary was completed following each exercise session, recording the number, sets and repetitions of exercises that the patient had undertaken to calculate a percentage of self-reported exercise. This would be the other potential choice for the primary exercise adherence outcome in a future full scale RCT. The aim of the exercise diary was for the participant to complete it in real time, differentiating it from the other two measures of adherence which rely on participant recall. This could be of interest as recall can potentially be variable (Schmier and Halpern 2004).

- Global rating of Change (GROC): This is the participants' perception of their change since their initial appointment; scores include 'very much worse' 'much worse', 'a little worse', 'about the same/no difference', 'a little better', 'much better', 'very much better' (Kamper et al 2009). This was included to see if improving exercise adherence also improves participants' perception of their treatment outcome.

Where possible, baseline appointments took place just before the initial physiotherapy appointment, or where this was not possible, no more than 1 week prior to the physiotherapy

appointment. Follow up appointments were also arranged to take place just before or just after physiotherapy sessions where possible. If this was not possible, participants were offered the chance to attend the research unit for follow up, to have a follow up at home, or to be sent the questionnaire and pre-paid envelope in the post to return when completed.

Adverse event monitoring and reporting

Clinicians were encouraged to report any adverse event to the study PI. The PI judged the seriousness, expectedness and relatedness to the intervention of any possible serious adverse event. If needed this was reviewed by an independent clinician and if confirmed The PI was then responsible for reporting it to the REC with 15 days of becoming aware of the event.

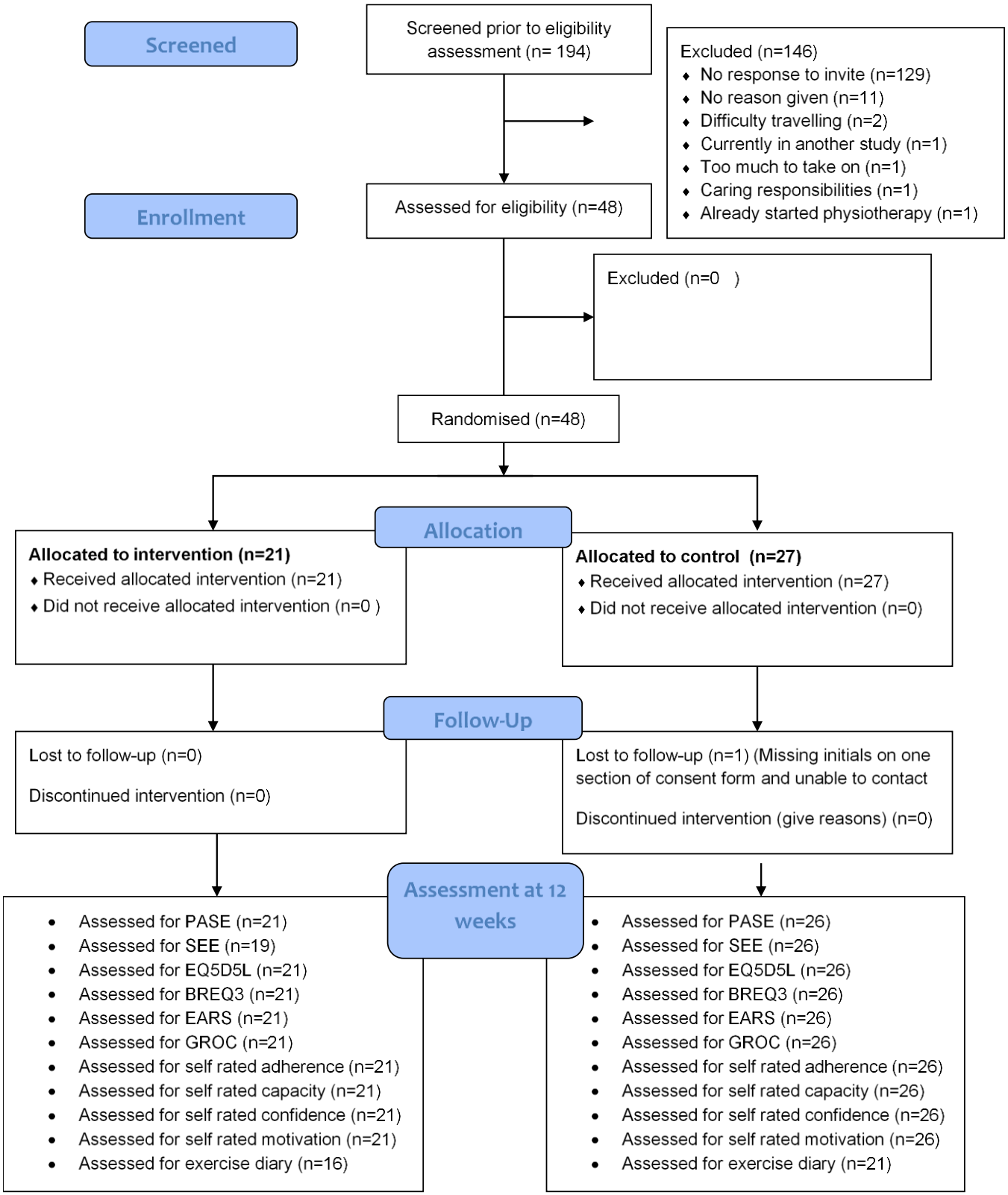
Governance

The study was sponsored by Oxford Brookes University. The day to day running of the study was overseen by the study PI with support from the PhD supervisory team.

Study flow chart

A flow chart of the study as recommended by Eldridge et al (2016) can be seen in figure 6.1

Figure 6.1 Flow chart of the feasibility RCT



6.3.5 Sample size calculation

The aim for the sample size for this feasibility RCT was 40 to 50 participants. Whitehead et al (2015) suggests that pilot trials recruit 20 participants per group, or 25 participants per group, in order to allow for an 80% or 90% powered main trial respectively, assuming a small effect size of 0.1 to 0.3. Therefore, the minimum recruitment target was set at 40, with an upper limit of 50 participants.

6.3.6 Embedded qualitative study

As part of assessing the feasibility an embedded qualitative study took place is described in detail in chapter 7.

6.3.7 Randomisation and blinding

Participants were randomised based on the physiotherapists that they were seeing. Before the start of the trial, all physiotherapists involved in the trial were randomised to either deliver usual care, or the AERO intervention using a random number table. Therefore, the participants were allocated to usual care or the AERO intervention based on the physiotherapist who would be undertaking their care. The assignment of patients to physiotherapists for physiotherapy treatment, including study participants, was undertaken by administration staff, as is routine practice in the department conducting the trial. The investigator or other research staff were not involved in this process, and therefore could not influence treatment allocation. The decision to do this was to aim to prevent contamination between groups by ensuring that a physiotherapist would either deliver the intervention arm, or usual care, but not both. It was felt that if a physiotherapist was delivering both treatments, it might be possible for usual care participants to receive aspects of the intervention, simply because the physiotherapist had become used to using exercise adherence approaches with the intervention arm. To further avoid contamination between the treatment groups, the importance of non-contamination in the trial was articulated to all the trial physiotherapists. Additionally, those delivering the intervention arm were told not to discuss the intervention with colleagues delivering the usual care arm. It was not possible to blind either the participants or physiotherapists in this trial. However, follow up data, which was all self-report and therefore generated by the participant themselves, was collated and entered by a blinded research assistant.

6.3.8 Data analysis

Feasibility measures such as recruitment, retention and randomisation were analysed using the study database on Excel 2010 (Microsoft Corp 2010) and entries made on reply slips. Acceptability of the intervention was analysed using qualitative methods and reported in detail in chapter 7, fidelity was analysed by reviewing the fidelity checklists undertaken by the author. For additional outcome measures, SPSS 26 (IBM Corp 2019) was used. Demographic data was analysed using descriptive statistics. Group mean or mode scores are presented, and standard deviation scores in addition to 95% CIs are given. Due to a feasibility design this study was not powered to test effectiveness and therefore inference of effect should not be drawn from the results. However, effect sizes were calculated to help with estimating the sample size of a future RCT. When data were parametric effect sizes were calculated with Cohen's d by calculating the difference in means divided by the standard deviation. If data were non-parametric then effect sizes were calculated with Pearson's correlation coefficient r by dividing the Mann Whitney U test z-score by the square root of the number of observations, as recommended by Field (2013).

6.3.9 Ethics

This study was approved by the South Central Oxford C Research Ethics Committee (REC), REC Ref: 18/SC/0416. Appropriate steps were taken to treat the data ethically, such as removing any names, places, or identifiable information from transcripts. Stakeholder involvement in the study design is outlined in chapter 5.

6.4 Results

6.4.1 Feasibility

Recruitment: The AERO trial recruited 48 participants over a 12-month period. Table 6.1 and Figure 6.2 show monthly and cumulative recruitment figures. The average number of participants randomised in a month was 4 (SD 2.34). Invitation letters were sent out to 194 potential eligible patients, meaning that 24% of those invited to take part in the AERO trial were randomised. Table 6.2 gives projections for recruitment to a future full scale RCT based on these figures, assuming uniform recruitment at difference sites

Table 6.1 AERO recruitment by month and cumulative tally.

Month	Recruitment in month	Cumulative total
Sept 18	2	2
Oct 18	2	4
Nov 18	1	5
Dec 18	3	8
Jan 19	8	16
Feb 19	5	21
Mar 19	7	28
Apr 19	4	32
May 19	6	38
Jun 19	2	40
Jul 19	6	46
Aug 19	2	48

Figure 6.2 AERO Monthly and Cumulative recruitment

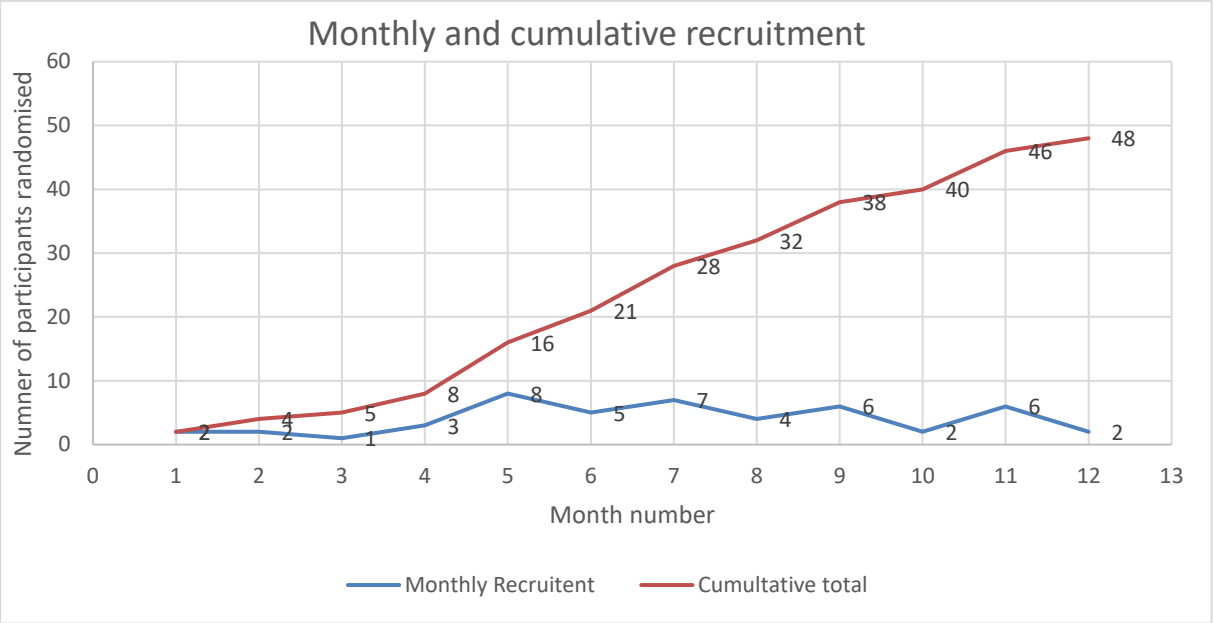


Table 6.2 Projected recruitment for a future RCT, based on recruitment observed.

Length of recruitment period	Number of study sites	Total participants randomised	Total number of invitations required
12 Months	1	48	194
12 Months	2	96	388
12 Months	3	144	582
12 Months	4	192	776
12 Months	5	240	781
24 Months	1	96	388
24 Months	2	192	776
24 Months	3	288	1164
24 Months	4	384	1552
24 Months	5	480	1940

Based on the reply slips the following reasons were given for non-entry into the AERO trial:

- No response to the invitation letter n=129
- Not wanting further information, no other reason given n=11

- Difficulty getting to the hospital n=2
- Already taking part in other research studies n=1
- Too much to take on n=1
- Caring responsibilities n=1
- Reply slip received to late/already started physiotherapy n=1

Randomisation: Of the 48 participants recruited to the AERO trial, 27 were randomised to receive usual care, and 21 to receive the AERO intervention. Baseline characteristics of both treatment arms are given in table 6.3

Table 6.3 Baseline characteristics of participants

Variable	Usual Care	AERO Intervention	All Participants
	n= 26	n= 21	n= 47
Age in years	74.58 (SD 7.05)	74.10 (SD 6.20)	74.36 (SD 6.62)
Male/Female	9/17	8/13	17/30
TFI	5.04 (SD 3.34)	4.86 (SD 3.41)	4.96 (SD 2.84)
PASE	137.61 (SD 82.67)	112.5 (SD 70.08)	126.38 (SD 82.67)
SEE	64.69 (SD 21.52)	59.14 (SD 19.43)	62.21 (SD 20.58)
Self-rated capacity to exercise	6.77 (SD 2.47)	6.48 (SD 2.66)	6.64 (SD 2.53)
Self-rated confidence to exercise	7.35 (SD 2.56)	6.48 (SD 2.58)	6.96 (SD 2.58)
Self-rated motivation to exercise	7.85 (SD 2.54)	7.29 (SD 2.43)	7.60 (SD 2.48)

TFI = Tilburg Frailty Index, PASE = Physical Activity Scale for the Elderly, SEE= Self-efficacy for exercise. Scores given are means with standard deviation in brackets.

Acceptability of intervention and study procedures: The acceptability of the AERO intervention and study procedures were explored in qualitative interviews. The results will be outlined in chapter 7.

Approaches used by physiotherapists with participants in the intervention group: The various approaches available for physiotherapists to adopt in the AERO trial were utilised as follows.

- Review of exercise programme = 20 (95.24%)
- Discussion of barriers, problem solving, action plan = 11 (52.38%)

- Motivational interviewing = 7 (33.33%)
- Goal setting review = 6 (28.57%)
- Review of method of delivery = 5 (23.81%)
- Cues = 3 (14.29%)
- Reminders = 2 (9.52%)
- Decision balance sheets = 0 (0.00%)
- Behavioural contract = 0 (0.00%)
- Monitoring call = 0 (0.00%)

Retention of participants: Of the 48 participants recruited to the study, 1 participant's data was withdrawn on advice from the local R&D department. This was due to missing initials, indicating they had not consented, to one item on the informed consent form. This was noticed after the participant had completed their physiotherapy treatment and it was not possible to contact them despite several attempts to do so. This left 47 participants for data analysis. At 6 weeks one questionnaire dataset was missing because the participant was uncontactable during the appropriate review period giving a retention rate of 97.87%. At 12 weeks one questionnaire dataset was missing because the participant was uncontactable during the appropriate review period also giving a 97.87% retention rate. With some of the completed questions there were sections or items of missing data, the overall completion rate for each outcome measure is outlined in table 6.4. The completion rate for the exercise diaries was 76.6%, for all other items it was above 93%.

Table 6.4 Completion rate of outcomes used in the AERO trial

Outcome	Completion at 6 weeks	%	Completion at 12 weeks	%
PASE	45/47	95.74%	46/47	97.87%
SEE	46/47	97.87%	44/47	93.62%
EQ 5D 5L	45/47	95.74%	46/47	97.87%
BREQ3	46/47	97.87%	46/47	97.87%
EARS	46/47	97.87%	46/47	97.87%
GROC	46/47	97.87%	46/47	97.87%
Self-reported adherence (0-10)	46/47	97.87%	46/47	97.87%
Self-reported capacity (0-10)	46/47	97.87%	46/47	97.87%
Self-reported confidence (0-10)	46/47	97.87%	46/47	97.87%
Self-reported motivation (0-10)	46/47	97.87%	46/47	97.87%
Exercise diary	-	-	36/47	76.60%

Fidelity: Ten sessions of the intervention were monitored by the PI as part of fidelity checking. In all 10 sessions, the participants completed all questions in both part 1 and part 2 of the intervention (5.6.1.2.1), and they all were assessed on the COM-B domains of capability, opportunity and motivation (Michie et al 2011), at least one adherence strategy was used with all 10 participants, and they all had exercises recorded in their exercise diary. Correspondingly fidelity was categorised as being excellent.

Physiotherapists who delivered the AERO intervention

Information on the banding and years of experience of the physiotherapists who delivered the AERO intervention can be found in table 6.5.

Table 6.5 Characteristics of physiotherapists who delivered the AERO intervention

Variable	Score
Banding	Band 5 x 1 Band 6 x 3 Band 7 x 3
Years of Experience (years)	12 years (SD 7.39 years, range 1 to 25)

6.4.2 Additional outcomes

All additional outcomes were collected at both 6 and 12 weeks with the exception of the exercise diary that was collected only at the 12 week follow up. These are presented in table 6.6

Table 6.6 Additional outcomes

Outcome measure	Mean scores at 6 weeks (AERO v Control)	Effect size	Mean scores at 12 weeks (AERO v Control)	Effect size
EARS (score 0-24)	18.25 (SD 5.82) v 16.35 (SD 5.87)	r=0.17	17.38 (SD 6.78) v 15.64 (SD 6.60)	r=0.16
Exercise diary (% of exercise completed)			77.21% (SD 18.33) v 62.58% (SD 27.47)	d=0.59
Self-reported adherence (0-10)	7.35 (SD 3.00) v 6.77 (SD 2.86)	r=-0.13	7.10 (SD 2.77) v 6.60 (SD 3.00)	r=-0.08
PASE	131.48 (SD 70.68) v 132.96 (SD 70.75)	r=0.01	137.14 (SD 98.57) v 132.45 (SD 70.86)	r=0.02
SEE (0-90)	61.00 (SD 22.07) v 61.50 (SD 22.83)	r=-0.04	52.53 (SD 28.16) v 58.20 (SD 23.58)	r=-0.08
Self-rated capacity to exercise (0-10)	7.00 (SD 2.73) v 7.58 (SD 2.05)	r=-0.14	7.48 (SD 2.48) v 7.44 (SD 2.60)	r=-0.03

Self-rated confidence to exercise (0-10)	7.50 (SD 2.95) v 8.00 (SD 2.26)	r=-0.07	7.48 (SD 2.84) v 7.48 (SD 2.95)	r=-0.003
Self-rated motivation to exercise (0-10)	8.05 (SD 2.54) v 8.15 (SD 2.13)	r=-0.02	7.57 (SD 2.82) v 8.00 (SD 2.31)	r=-0.05
BREQ3 (-24 – 24)	11.55 (SD 8.25) v 9.27 (SD 8.36)	r=-0.13	9.71 (SD 8.31) v 8.56 (SD 9.40)	r=-0.11

6.4.2.1 Patient reported improvement in symptoms

GROC: Both groups reported similar changes in GROC, at 6 weeks both groups had median and mode scores of 1, at 12 weeks both groups had a median of 1 and a mode of 2. All scores for GROC are presented in table 6.5

Table 6.5 Tally of GROC scores for both groups at 6 and 12 weeks

GROC score	Usual Care		AERO	
	6 weeks	12 weeks	6 weeks	12 weeks
3	3	5	2	2
2	6	6	3	7
1	12	5	7	5
0	4	5	5	3
-1	0	1	0	0
-2	0	2	1	1
-3	1	1	2	3

Adverse events

There were no adverse events or serious adverse events reported during the study.

6.5 Discussion

Feasibility or pilot work can be an important aspect of future trial design (Blatch-Jones et al 2018). The AERO trial set out to test the feasibility of an exercise adherence intervention on exercise adherence for older adults with MSK conditions. In assessing feasibility, to determine if a full scale RCT can be undertaken, several factors were reviewed, recruitment, randomisation, acceptability of the intervention, retention and fidelity. The data gathered on these components demonstrated that the AERO intervention and associated study procedures were feasible, and that the intervention has the potential to be trialled in an adequately powered RCT, although there were some considerations that will need to be reviewed prior to any future study.

The recruitment target for the trial was met and suggests that with additional sites an appropriate number of participants could be recruited to a larger adequately powered RCT. However, the exact number of participants required would depend on the primary outcome measure used (Zhong 2009). There are two potential choices of primary outcome for a future trial, either percentage of exercise recorded in an exercise diary, or EARS. Using data from the AERO trial, the exercise diary had an effect size of d=0.59, using this and assuming α=0.05 and 1-β = 0.8 and a 10% loss to follow up the sample size required would be 105. For EARS the effect size was r=0.17, assuming the same values for α, 1-β and loss to follow up the sample size required would be 1211. Projections of future recruitment outlined in the results suggest a large sample could be recruited in a 12 to 24-month period, one that would easily meet the sample size estimate, if the percentage of exercise from exercise diaries was used as the primary outcome measure. It would clearly be important to measure exercise adherence in a future RCT and one of these measures could be considered as a potential primary outcome. However, an additional primary outcome may well be required, one that reflects health and quality of life in line with the logic model from chapter 5 (Figure 5.2). In this way it could be demonstrated that improving exercise adherence either does or does not also improve health outcomes. This means consideration would need to be given to an appropriate measure and that should also inform any sample size calculation. The ratio of people sent study invitations to number of participants enrolled is also encouraging with regards to recruitment to a full trial, with 24% of those sent information about the study being randomised. Retention in the trial was good with only one complete dataset missing at 6 weeks and 12 weeks. Missing data was low for all measures with a completion rate of at least 93%, with the only exception being the exercise diaries, which due to either being lost or not completed had a completion rate of 76.6%. In a future RCT consideration needs to be given to the monitoring and recording of exercise adherence. It might be that alternative methods of collecting this data could be considered, for example the use of inertial sensors (Bavan et al 2019), or accelerometery particularly as the reliability of self-report diaries are questioned (Nicolson et al 2018).

Randomisation is an important factor in minimising bias (Altman and Bland 1999, Pocock 1983), that of selection bias (Hills et al 2009, Schulz 1995) and confounding bias (Schulz and Grimes 2002). In this trial all the physiotherapists were randomised to deliver either usual care or the AERO intervention before recruitment began. So, each physiotherapist either delivered Usual Care or the AERO intervention. Participants' allocation was therefore based on the physiotherapist they were scheduled to see, a task undertaken by administration staff, completely separate from the trial team. This method has the strength of preventing clinicians from having to deliver both arms of the trial and thereby potentially contaminating the usual care arm. It also prevents issues of clustering if randomisation occurs via sites. It did however present a number of challenges. For example, if a participant's care was transferred between physiotherapists, as happens on occasions in busy departments, it needed to be to another therapist randomised to the same treatment arm. Similarly, clinicians can leave or join a department mid-trial. Research trial issues such as these may not be the primary concern of clinical or administrative staff and can therefore be reasonably resource intensive to keep track of. Also randomising by clinician has the potential of opening the study to bias. Although appointments were scheduled by administration staff who were separate from research staff, an appointment is nonetheless made with someone being able to decide treatment allocation. There therefore remains the possibility, all be it small of allocation not being random.

Randomising by participant would resolve this issue and ensure that allocation to groups was truly random and could be a consideration for a future RCT.

Post intervention qualitative work demonstrated the acceptability of the AERO intervention for both clinicians and participants (chapter 7). One of the considerations when developing the AERO intervention was that it would be practical to use in a 'real world' clinical setting, and could be added to a standard physiotherapy session without too much complication, either for the clinician or the participants, something which has been achieved based upon the themes generated in the qualitative work (chapter 7).

Another important consideration for feasibility is fidelity. The importance of fidelity in supporting optimal outcomes has been highlighted by An et al (2020). The authors suggest five important dimensions of fidelity; adherence, dosage, quality of intervention delivery, participant responsiveness and programme differentiation. Fidelity checking took place at 10 AERO sessions, which accounts for 47.6% of participants randomised to the intervention arm. From the fidelity checking the adherence to the intervention, and dosage, e.g. clinicians following the protocol, can be classified as being excellent. Quality of intervention delivery and participant responsiveness can be inferred to be good from both fidelity checks and qualitative interviews (see chapter 7). In terms of programme differentiation, it is uncertain how high the AERO trial would score on this domain. There is no definitive data on what took place in the usual care sessions, e.g. how much they differed from the AERO intervention. Clinicians delivering usual care received no information about the AERO intervention content, or how to deliver it. However, no restrictions were placed on what approach physiotherapists delivering usual care adopted. It is unknown how BCTs might have informed their practice as physiotherapists are known to utilise a small number of them in similar areas such as physical activity prescription (Kunstler et al 2018, 2019). There is the possibility that clinicians delivering usual care could have regularly used behavioural strategies like that found in the intervention so diluting any potential difference between groups. Any future RCT will need to account for this, by either monitoring any usual care group, or considering if there needs to be any restriction on the strategies physiotherapists are able to adopt to make usual care a more uniform and reliable intervention approach.

This trial aimed to investigate the feasibility of delivering and trialling the AERO intervention, and to that end all the primary outcomes have been discussed above. However, several additional outcomes were collected. This feasibility trial was not adequately powered to detect any changes in the secondary outcomes described, and it did not aim to investigate their effectiveness, therefore inferential statistics were not used. Effect sizes were reported to help with setting a sample size for a future RCT. Of particular relevance in the secondary outcomes were three measures recording adherence to exercise, the EARS, self-reported adherence and the exercise diaries. These three measures gave 5 time points to consider adherence to exercise in trial participants, at 6 weeks and 12 weeks for EARS, at 6 weeks and 12 weeks for self-reported adherence, and at 12 weeks for the exercise diaries. The effect sizes observed were small for EARs and self-reported adherence on a scale 0-10, however the effect size for exercise diaries were moderate. Both groups were given a diary, and Moseley (2006) reports that diaries can help improve adherence of themselves which corresponds to the comments made by physiotherapists in the qualitative study conducted after the trial (chapter 7). In their interviews, physiotherapists questioned whether just being in the study along with the study procedures such as the diary prompted a change in behaviour. This could have

served to dilute any effect of the intervention. Interestingly in the measures that were recorded at each time points it can be noted that adherence declined in both groups from 6 weeks to 12 weeks. This is in line with previously reported trajectories of exercise adherence that either starts and remains low, or decreases over time (Nicolson et al 2018).

This is interesting in the light of some of the other secondary measures, SEE, self-reported capability, self-reported confidence, self-reported motivation, and RAI all either declined or levelled off by 12 weeks. This raises a few points; firstly the possibility that participants rate themselves too highly before commencing an exercise programme. This could be due to wanting to give the 'right' answer, or alternatively that they tend to overestimate their ability on any task, this effect also called the Dunning-Kruger effect (Dunning 2011). This has been reported in areas as disparate as 80 % of people estimating their driving ability as better than average (McCormick et al 1986), to 32%-42% of engineers estimating their performance as being in the top 5% in their companies (Zenger 1992). It might be that it is commonplace to overestimate our ability to perform and stick to a task such as an exercise programme without too much consideration, before the task has even started. If so, it might be that the concepts around planning, initiating and maintaining an exercise programme need more in-depth exploration at the start of any intervention. Alternatively, it could be related to the fact that exercise programmes can be boring to maintain, particularly over an extended period, or that is can be demotivating if no progress is seen (chapter 7). Palazzo et al (2016) reported that the burden of an exercise programme, including it being boring is a barrier to adherence, if so, it might be that more can be done to vary programmes to maintain interest. Whatever the reason, this trajectory of exercise adherence, may call for interventions to not just front load information and strategy but to consider the approach moving forward in time.

6.5.1 Strengths and limitations

The strengths of this trial include the use of an intervention developed using an Intervention Mapping approach (Bartholomew Eldredge et al 2016) and underpinned by COM-B (Michie et al 2011), in order to offer tailored strategies to individual participants. Similar approaches have been used in other areas, where COM-B has been used to develop an intervention to address the unique barriers to physical activity of breast cancer survivors (Johnson et al 2019), or to target the appropriate domain to change behaviour to reduce sedentary time in those with COPD (Cheng et al 2017). This approach is also suitable in the field of exercise adherence for older adults with MSK conditions. Nicolson et al (2018) suggested that single BCTs are unlikely to be effective at facilitating exercise adherence for everyone, all of the time. A 'toolbox' approach to adherence is recommended by the WHO (World Health Organisation 2003), and NICE (2014) also recommends that behaviour change interventions should meet the needs of the individual which underlines the importance of an approach like AERO that is tailored to each participant.

The limitations of this trial include it being conducted at a single site, the use of self-reported adherence measures, a lack of objective measures such as inertial sensors (Bavan et al 2019) or accelerometery (Nicolson et al 2018) which have been used in other studies. There is also the need to consider a longer term follow up. It would be possible to address all of these issues in a full-scale RCT. Additionally, the method of randomisation by physiotherapist created a number of challenges and has the potential of making treatment allocation not random. Therefore randomising by participant to ensure treatment allocation is fully random would be considered for a full RCT in the future.

6.5.2 Conclusion

The AERO intervention in which participants received tailored adherence strategies based on a behavioural assessment added to a standard physiotherapy session is a feasible intervention. The acceptability of the intervention and associated trial procedures needs to be established in order to determine if the AERO intervention should be trialled in an adequately powered RCT. This will be considered in chapter 7.

7 'I won't say I've done it religiously': A qualitative study exploring the acceptability of the AERO trial and experience of adhering to an exercise programme

7.1 Summary

This chapter presents the results of a qualitative study which took place following the AERO feasibility RCT. Both patients receiving treatment and physiotherapists delivering the AERO intervention were interviewed to gain their views on the acceptability of the AERO study, and to explore patient participants' experience of adhering to an exercise programme.

As this qualitative study involves participants who were both patients receiving physiotherapy and physiotherapists delivering the AERO intervention, it would be helpful to clarify the language used to describe them both. AERO study participants, who were patients attending physiotherapy will be referred to as patients. AERO study participants who were physiotherapists, delivering the intervention will be referred to as physiotherapists.

7.2 Introduction

The rationale for the AERO trial, the design and the quantitative results were presented in chapters 5 and 6. Previous qualitative research in the area was also presented in chapter 4.

The aims of this study were:

- To assess the acceptability to patients of the AERO trial
- To assess the acceptability to physiotherapists of the AERO trial
- To explore patients' experiences of trying to adhere to their exercise programme as part of the AERO trial

7.3 Methods

7.3.1 Design

A qualitative design was chosen, involving individual interviews with AERO trial patients and physiotherapists who delivered the AERO intervention. The interviews were semi structured and followed a topic guide (appendix 15 and 16), an approach commonly used in qualitative physiotherapy studies (Stenner et al 2018, Thomas et al 2019). The study design was set within an interpretive paradigm in order to explore the acceptability of the AERO trial procedures as experienced by both patients and physiotherapists, and to discover how patients found the experience of trying to adhere to their exercise programme. A description and justification of this paradigm has been given in chapter 4, section 4.3.1. The steps taken in the design, conduct and dissemination of this research have been guided by the COREQ Checklist (Tong et al 2007) (appendix 17). An alternative approach that could have combined the work in chapters 6 and 7 would have been to undertake a process evaluation (Moore et al 2015). Such an evaluation can help to determine why an intervention has been successful or not (Craig et al 2008), for example its failure may relate to the implementation rather than how effective it is, or could be. The work outlined in this chapter and chapter 8 overlap with aspects of process evaluation however, the work for this thesis was primarily focused on the feasibility of the AERO intervention and less focused on

outcomes that might be the end result of a process evaluation. Process evaluation could certainly be considered in the future when evaluating a full scale RCT.

7.3.2 Ethics

This study received ethics approval from the South Central Oxford C REC, REC Ref: 18/SC/0416. Appropriate steps were taken to treat the data ethically, such as removing any names, places, or identifying information from transcripts.

7.3.3 Participants

A purposive sample of 15 participants, including 10 AERO trial patients and 5 physiotherapists who delivered the intervention, were recruited to the study. Patients were invited ensuring a range of ages, self-efficacy for exercise and TFI scores, and that both treatment arms were covered. This involved the investigator reviewing baseline scores and then inviting potential participants to ensure the sample included those who were younger and older and those with relatively high and low self-efficacy for exercise and TFI scores. Finally group allocation was considered to make sure that participants came from both treatment arms. Patients were contacted to ask if they might be interested in this qualitative study, and if so, they were sent a study specific invitation letter and participants' information sheet. These were different and separate from the main AERO trial. All patients who had participated in the AERO feasibility trial had consented, via the consent form, to being contacted about an invitation to take part in an interview study. If patients were still interested, once they had read the study information, an interview was scheduled for a convenient time in a hospital or home setting, or a location that was convenient for them. The physiotherapists randomised to delivering the AERO intervention were approached in the same way. The investigator approached all physiotherapists who delivered the intervention arm of the AERO trial, if they were interested in participating a convenient time was scheduled for an interview. Once 5 physiotherapists had responded recruitment ceased and all participants, patients and physiotherapists gave written informed consent prior to their interview.

7.3.4 Data collection

Semi-structured interviews were chosen as this method of data collection allows for in-depth discussion and the generation of rich data from participants (Howitt 2016). All interviews were conducted by JR, a male physiotherapist and researcher with previous experience of qualitative methodology. JR made field notes during or after the interviews and all participants were aware that he was both a physiotherapist and the researcher undertaking this study. The interviews lasted between 17 minutes, 6 seconds and 45 minutes, 33 seconds and were recorded and transcribed verbatim by JR.

7.3.5 Data analysis

The data were analysed using thematic analysis as described by Braun and Clarke (2006). This approach is outlined in chapter 4 section 4.3.5. JR coded all transcripts, FT, a female anthropologist, coded 3 transcripts and meetings were held to discuss agreements and disagreements in coding. KB, a female physiotherapist, was available as a third researcher to resolve disputes if agreement could not be reached. Subthemes and themes were initially generated by JR, and then refined by JR and FT with KB available to resolve any disputes. Data is presented in two sections, the first presents data from patients and physiotherapists relating to the acceptability of the AERO trial. The second presents patient data relating to the experience of adhering to an exercise programme.

Data analysis was conducted using word and tabletop organisation of data. Further details of data analysis are provided in appendices 18-21. Appendix 18 gives examples of coding from two transcripts, appendix 19 shows a list of 1st order codes generated after coding all transcripts, appendix 20 shows how codes were grouped into sub-themes, and appendix 21 shows how sub-themes were grouped into themes.

7.4 Results

Ten patients and 5 physiotherapists took part in semi-structured interviews. Their characteristics are given in tables 7.1 and 7.2.

Table 7.1 Patient Demographics

Variable	Score
Gender (Male/Female)	4/6
Age (Years)	76 (SD 8.51, range 66 – 91)
Self-Efficacy for Exercise Score	62.44 (SD 22.75, range 29 – 87)
TFI score	5.5 (SD 3.21, range 2 – 12)
PASE score	139.52 (SD 71.18, range 27.2 – 231.46)
Treatment group (usual care/intervention)	5/5

Table 7.2 Physiotherapist Demographics

Variable	Score
Gender (Male/Female)	1/4
Age (years)	38.4 years (SD 9.1 years, range 30 – 49)
Years of experience (years)	15.2 years (SD 7.8 years, Range 8 – 26)

Section 1: Acceptability of the AERO trial

The generated themes with their subthemes are presented in table 7.3.

Table 7.3 Themes and subthemes for acceptability

I signed up because	Experience of taking part	The components	Considerations for the future
To help others	Worthwhile	Instruction	Paperwork amendments
Understand the need	Easy	Diary	Diary limitations
I'll get looked after	Fitted	Questionnaires	Longer follow up
Important and interesting	Helped me think	Theory	Behaviour change before the intervention
		It can be tailored	
		Paperwork	

7.4.1 I signed up because….

In this theme patients and physiotherapists described why they agreed to take part.

Patients outlined several reasons for taking part: it might help others, the understanding that research requires participants, and that in a study you might receive better care than would have been the case.

> *…some sort of altruistic sense you know giving a bit back from the incredible care I get (Patient participant 4)*

> *Well I signed up because we were always trying to get people to signup for studies and it's always difficult so I thought well at least I can do my bit and sign up for it (Patient participant 10)*

> *Right so why I decided to take part is that in any sort of research study I think….you feel that you'd get a lot of attention and support (Patient participant 5)*

Physiotherapists described the study as being about an issue that is important, that it was of interest and pertinent for their profession and therefore they wanted to take part.

> *I think it's an interesting study because down the line you realise that people do not do their exercise regimes for a variety of reasons (Physiotherapist participant 5)*

> *…it's definitely a massive area for us and whether…if we can increase adherence then we are in a lot better position…erm…so I can definitely say it's got a lot of worth, it is then taking it forward from there is the next thing (Physiotherapist participant 4)*

> *No it's absolutely fine because I think with the…the study as well it was…it seem really relevant in terms of what you were looking into (Physiotherapist participant 1)*

7.4.2 Experience of taking part

Following on from signing up, patients and physiotherapists described their experience of being part of the AERO trial. Patients outlined a process that was valuable, and that taking part had been straightforward.

> *Yeah it was fine I mean it wasn't particularly onerous with regard to the time, the questions that you...you had nicely laid out format and it was very straight forward, it was almost idiot proof I'd go as far as to say that...you kept in touch, it was absolutely fine (Patient participant 9)*

> *…no I thought it was very well oiled very easy to take part yeah (Patient participant 4)*

> *I've found it quite worthwhile to have taken part (Patient participant 2)*

The physiotherapists interviewed descried how they were able to incorporate the AERO intervention into their physiotherapy sessions without it being a burden, and how the intervention had helped them to think more about relevant aspects of exercise adherence.

> *No it's good. I generally quite liked it and I haven't felt like it's been as time-consuming as other trials have been like it fitted into my…I…I felt like it fitted into the appointment time quite nicely without feeling like I was absolutely rushing to…erm to get everything done (Physiotherapist participant 3)*

…so didn't take a lot of extra time because it was doing things you probably should be doing anyway, and if you are going to input those things long-term then you'd hoped to make your intervention more likely to be useful for the person anyway so…erm…yeah it was absolutely fine in terms of the time side of things (Physiotherapist participant 1)

…it made me think a bit more about those aspects of their capability and how it would relate to their adherence (Physiotherapist participant 1)

7.4.3 The components

In this theme patients and physiotherapists discussed specific components of the trial. For patients this included being given instructions, completing questionnaires and an exercise diary – all things which were either no problem, or even potentially helpful.

Because [in the study] I'd got to follow the rules you see, there are rules to be followed, I can do that…leave me on my own and I'm not good (Patient participant 1)

No, no [the questionnaires] not burdensome at all, no it's always interesting to have a chance to sort of think about…I can never tell if I've changed much erm but to think about what I'm doing and why and the effect that it's having it's useful (Patient participant 3)

…keeping a diary, well actually that…that actually helps you to maintain discipline (Patient participant 6)

Physiotherapists spoke about the underpinning theoretical model which they felt was helpful, the fact that they could tailor approaches to the individual, which was felt to be particularly useful.

…it's a good framework to use you know, COM-B, because if…if you…if you…you will then will address all those areas and that can also help with you in the conversation you have (Physiotherapist participant 2)

…with this study there is so many different options in terms of ways you can help with adherence and I think that makes that less…erm…like less one track, if that makes sense? (Physiotherapist participant 4)

Physiotherapists reported that having to read through the study paperwork several times to familiarise themselves with it could be a bit of a burden.

…so each time I did it I had to read through all the literature that you sent through which is a bit of a nuisance but I think probably if they were close together and a bit more then I wouldn't have had to do that (Physiotherapist participant 5)

7.4.4 Considerations for the future

In this theme patients and physiotherapists discussed improvements or considerations that might be of use for a future version of the AERO trial. This included amendments to the trial paperwork, considering the limitations of an exercise diary, and running the trial over a longer time period to allow for long term follow up.

I wouldn't mind having more lines on those papers [exercise diary] (Patient participant 3)

I can see that and the other thing of course is there must be people who fudge what they say they do [on an exercise diary] (Patient participant 9)

…it's a bit like when you've forgotten to do your homework and do it on the bus isn't it? And you just tick through [the exercises in the diary] and you're like yes I've been doing them (Physiotherapist participant 1)

Yeah, no it needs to be much longer because I think…so the one [patient] I think would be really successful if monitored now was really not success at the 12-week point (Physiotherapist participant 5)

Another point that was discussed was the potential for people to change behaviour regardless of whether they had received an intervention or not. Just being part of the study and having an exercise diary seemed to have the potential to change motivation.

But being part of the study…I felt that the people involved were all very focused and I felt…initially I felt that it was important that I stuck with the regime that was being presented to me (Patient participant 5)

I think we've talked about this before but the one thing I noted was that most of them were abnormally more compliant than most of the patients that I would generally see on a…you know…day-to-day basis So I don't know whether it is self-selecting and therefore you're getting people that perhaps don't represent the average population (Physiotherapist participant 2)

Oh very helpful. I mean as you can see I still…I'm still doing it [the exercise diary], I mean it's good feedback for me and it's a bit of an incentive to keep at it, because when I see a blank day where I haven't done anything and I don't have a good reason I notice that I feel worse and when I see that I have kept it up I feel better (Patient participant 3)

Section 2: Experience of adhering to an exercise programme

The generated themes and their subthemes are presented in table 7.4

Table 7.4 Themes and subthemes for patient experience.

It's not easy	Facets of the physio	Facets of the individual	Physiotherapist patient relationship	This really helped
A hard task	The Physio	Who I am	Working together	Monitoring and feedback
Routine	Communication	My relationship with exercise	Being heard	Seeing a difference
Challenges		What I need	Hope	Understanding why

7.4.5 It's not easy

This theme describes the challenge of adhering to an exercise programme, with both patients and physiotherapists acknowledging that sticking to it can be difficult, with some even describing guilty feelings for not undertaking their prescribed exercise as intended.

> *I felt that I wasn't committed enough to it and erm because of situations it was very difficult…I mean it sounds silly for a few exercises but it's been madness this last year (Patient participant 5)*

Patients described how the difficulty with adhering to an exercise programme is influenced by routine and structure. So even if undertaking an exercise programme has been incorporated into the structure of a normal day, any change to routine can cause problems.

> *…yeah that's really difficult because if you're not at home…being at home and doing it makes it easy, if you're away for the weekend sometimes it's very difficult to complete it (Patient participant 4)*

> *I was able to do it and sometimes perhaps when I was on holiday it wasn't quite as thorough as it would've been when you get 9 o'clock at night and then you think "Oh s*** (Patient participant 9)*

Patients discussed specific challenges which had the potential to make sticking to an exercise programme even more challenging. These included not noticing an improvement:

> *…well to make it worthwhile [I need to know why I should be] continuing to do something that I cannot see makes any difference, and it was no better, it's now been four years…five years since I broke it…and it's…it's worse, I mean it's no better (Patient participant 10)*

> *…and I can see you are doing something you don't really want to do for three weeks it's not making any difference at all that you can see, why would you keep doing it just because someone said, unless you strongly believe that someone (Physiotherapist participant 5)*

Some also observed that physiotherapy exercise programmes can be, or become, boring and not what they might regard as enjoyable:

> *I mean they're boring exercises, they…I don't enjoy just moving my body for the sake of moving my body and that's the difference between doing the exercise bike and going on a bike ride, I enjoy going on a bike ride in a way that I don't enjoy doing an exercise bike, except that I know that…I know that I made my blood flow faster and therefore have nourished my bones and the rest of me better than if I hadn't done it but that's not the same as seeing pretty sights and hearing the birds sing and all that (Patient participant 3)*

> *…after they have got bored with it and it's a wet Tuesday in November you know, that…that I could well understand why people would give it up (Patient participant 6)*

Pain was another consideration. For some it was tolerable, but for others it had a big impact on what they could do, or even contemplate doing.

Occasionally it can interfere with them but basically because I got pain all the time I ignore it so I've not to abandon going to an exercise class or going to aqua physio I've never had to abandon it due to pain (Patient participant 6)

I guess it's paradoxical, but in my experience it's worse the worse the pain is. My whole being is taken up in the pain, and the only motivation is to avoid anything that makes it worse – not to do anything that might in the long term make it better. Things become very immediate, and the world of possibility becomes very small, even to the point of really being able to pay attention to anyone else – the pain almost blots them out (Patient participant 3)

7.4.6 Facets of the physio

In this theme patients spoke of the importance of who their physiotherapist was, how the physiotherapist made them feel, and how they communicated about exercise. Patients valued being seen by someone who was supportive, who made them feel like they were the only patient on the books, and someone who wanted them to succeed.

I wasn't just another fat middle aged woman who…who was not doing it very well, and her sense of both interest and support really helped a lot (Patient participant 3)

I think the fact that you think your physio is there for you and wanting the best for you and so you're wanting to do the best (Patient participant 5)

Patients also described their physiotherapists' communication, it was felt to be important that the physiotherapist can manage people, their feelings and expectations, and be realistic and flexible in their communication with patients.

…most physio is long term, so I think inherently there's some weakness in physio as a method but what else you gonna do? So to some extent feelings and expectation and management of that is quite a crucial point, it's all soft power stuff isn't it there's no hard and fast…no (Patient participant 6)

*…****** made it realistic and I mean obviously it was ****** that I was seeing but because of her approach and how it was presented I wanted to succeed in following the programme, so I think that would perhaps be a difference in that in the past if I've had physio and for some reason haven't been able to complete I felt very guilty. I wasn't made to feel guilty if I didn't complete what I was supposed to complete (Patient participant 5)*

Err well…If I couldn't manage it we chatted it through and we...he came up with a different slant on things (Patient participant 1)

7.4.7 Facets of the individual

In this theme patients described the importance of who they were, their perceptions of self, and how we are all individuals, therefore we have different feelings about exercise, and may need different approaches to help in the area of exercise adherence.

Personality was regarded as potentially important, and it was recognised that we all are different in this regard.

…part of it is a type of mentality the person has I mean I would say some things I have a tendency to be well no on a lot of things I tend to be a perfectionist (Patient participant 9)

I have a friend yeah who never gives up exercising, and it has improved her no doubt about it, but I don't have the same sort of thought process, do you see what I mean, I need a bit more chivvying on (Patient participant 1)

In addition to this, mental health can affect outlook, and this can have an impact on participants' ability to perform an exercise programme.

Oh a lot of it has to do with my state of mind I mean if I'm depressed or I'm really feeling bad about myself it's very very hard to do it because I just can't find the incentive in…in anyway (Patient participant 3)

Patients described that, as we are individuals, we all have differing perspectives and history related to exercise.

Well I've always done a sedentary…a sedentary…[job] always you see and that is why I'm no great exercise person you know because…so yes I did work but I did run a home at the same time and I did the things that everyone else does during their lifetime…but my hobbies are all sedentary as well you see, I like sewing and knitting and things, reading so you don't see my exercising very much in the ordinary way (Patient participant 1)

Differing expectations regarding exercise programmes were common, with low expectations potentially making the task of undertaking an exercise programme more difficult.

…yeah and it's never been the same since, so expectations, yes, if you're being brutally honest about it the expectation of…[exercise] is quite low that it will do anything good for you very soon, because it's not gonna be do two weeks of this and then you'll be alright and then I won't have any problems (Patient participant 6)

And I suppose the other thing would be what...what...how far when you start, how far you can expect to…what you can expect to achieve, what is the end goal? (Patient participant 9)

Patients described how they needed to feel valued as a person, to know that they were important.

…yeah yeah I mean this really was a different experience than I've had before and that's…that's part about the collaboration and also the sense that wasn't just…just….just my demographics I wasn't… I felt like I was a person (Patient participant 3)

…you have got to feel important, if you see what I mean, if they make you feel important then it is worth doing isn't it? (Patient participant 1)

There was the sense that some people need some assistance to help with sticking to an exercise programme.

Well it's an intricate matter really isn't it really er…you know I think people who just have a thorough positive attitude about things can do it a lot easier than those with so many self-

doubts and tend to crump at times, er I think need more structure and external source of supports for it (Patient participant 3)

Even for those who are committed to undertaking an exercise programme, motivation alone might not be enough: it is still possible to miss your exercise programme.

…yeah it isn't that you aren't motivated you just forget it yeah you know, I mean you know you've got to do it…its' got to be at the same sort of level you know you got it like build it…to sustain it over time (Patient participant 6)

7.4.8 Physiotherapist patient relationship

This theme described the importance of the physiotherapist and the patient coming together to work jointly, a relationship where the patient can be heard and be encouraged, and the physiotherapist can acknowledge the current situation, but offer hope for the future.

The need to work together was described as important in relation to adhering to exercise programmes and achieving the patient's goals.

Well I suppose it's the same things again really its understanding what she and I are trying to achieve yeah, me particularly obviously and her because it's her job (Patient participant 7)

It was acknowledged that there may be risks with developing too close a relationship with their physiotherapist.

Um yes, and but I respect the possible problem that building too strong a rapport makes you dependent on the physiotherapists, whereas the idea is to get you to do these things yourself and continue to do them yourself (Patient participant 2)

Nonetheless, it was felt that building rapport together was helpful, although this requires effort from both parties.

…it's nice to go to somebody who you look forward to seeing and err have a rapport with I mean asking a bit about their personal life and vice a versa, I think the physiotherapist has to give a bit away and err you have to give a bit away and find common ground (Patient participant 9)

For patients this can create a relationship where they feel that they are the sole focus of the physiotherapist's time and attention and an environment where they can be both heard and encouraged to undertake their exercise programme.

…so you feel like you're the only patient they've got, that's the way I felt, you know that they will be seen at least a dozen people at least during the day but at the time…and all the professionalism and expertise that they've got it's just…you know I'm in awe of them really they're just fantastic, but they make you feel like you're the only one and that's really really brilliant (Patient participant 4)

Oh absolutely, I mean sometimes before I've had someone who just said 'do this, do that' and because I'm…I'm sometimes frightened of doing certain things because of injuries I've had, or sometimes depressed just being told do that and if I say 'I'm afraid' to do it or 'I can't

do it' or 'how do I do it' if I ask something more about it, if they just say 'do it' erm that's not helpful at all, but working with someone if they say 'why are you afraid?' and I say is this safe given my injury just a little more information or just a little bit of interest in someone erm…makes a huge amount of difference, if they can hear….if they can both tell me what I need to do and hear my concerns about it with difficulties that I'm having doing it, that really cements the process and helps me feel it in my body more than if I'm just told do it, kind of the expectation that I'm just to do it when I can't or I'm afraid to or whatever (Patient participant 3)

Alongside this it was felt to be important for the physiotherapist to acknowledge how the patient was doing in the current moment, even if things were not necessarily going well, but also to offer hope for the future.

Is there a notion that can both encompass the severity of the pain and envision a longer-term situation that is different, beyond the pain? If these can be supported, I expect there's a better chance of holding on to motivation that will sustain exercise over the long-term (Patient participant 3)

7.4.9 This really helped

This theme outlines specific aspects of the intervention which patients found particularly helpful. It includes the usefulness of monitoring and feedback, of seeing a difference and moving towards goals, of having an exercise programme that fitted their life, and finally of being able to understand why they are being asked to do the exercise they are given.

Patients spoke of the helpfulness of being able to monitor their progress with their exercise programme. This helps in terms of being able to remember what they have done and also as a cue to exercise.

Well I think that's the only thing which kept me going was filling in the diary, the moment I don't have to fill it in anymore I stop doing the exercises, I mean I'll be faced by these blank pages on the diary and I'd think 'oh lord I better go and do something' and put in a tick but when I didn't have that in front of me I just forgot (Patient participant 10)

Well I found that [exercise diary] very helpful, I don't think I would have been as rigorous in exercising without it erm…and it also not only in terms of rigour but also in terms of memory, I think my memory is better than most of my age, but you know you do get to the stage of asking 'now did I really do that this morning, or was that last night?' and yes ticking the boxes is quite a useful tool (Patient participant 2)

Feedback was also described as important, particularly if progress with an exercise programme was slow.

…you need some feedback and then that can motivate you to go on further, as I say I think that I think the big problem for older people doing physio is the incremental benefit it comes very, very, very slowly and you know you say 'is it worth it? (Patient participant 6)

Linked with this idea, patients outlined how it was easier to maintain an exercise programme if you were aware of benefits and saw improvement.

…well when you do feel there is some benefit from it…it does make it that bit easier doesn't it really? You know you can say to yourself 'if you do this you are going to feel that much better'...and that is helpful (Patient participant 1)

…it's nice to feel you're getting better, to feel that it's working as well, you are getting sort of feedback maybe not on the day by day but you know when you look back over a week at your record 'oh yeah' I was having trouble with the exercise last week and now it's much easier and things like this (Patient participant4)

Patients also discussed the need to understand why they were being asked to do the particular exercises that they were doing.

…yeah yeah I think because the physio explained to me what…what…what she was trying o achieve in the exercises and what I was trying to achieve I think that helped because that made some sense (Patient participant 7)

*…err I mean I think perhaps you need to explain exactly...which ***** did to be fair why you are doing them, I think that is important, so you understand why are you doing the neck exercise and I remember they brought a skeleton in and showed the various bones and what she was trying to do erm and that was very useful because I understood why I was doing it (Patient participant 9)*

They also acknowledged that if exercise was just a disembodied task that someone else wants you them to do, it was unlikely that they would persist with it.

…people know different things about exercise and [for] some it's just a disembodied thing 'I'm supposed to do this' and I can talk to him about why that might be useful, just if I'm interested it might help them to feel more interested rather than just a disembodied task that somebody said they are supposed to do, because then it can fade away pretty quickly (Patient participant 6)

7.5 Discussion

The aims of this qualitative study were to gain an understanding of the views of patients and physiotherapists on the acceptability of the AERO trial, and to explore patients' experience of trying to adhere to an exercise programme as part of AERO. The findings outlined in this chapter suggest that the study and study components were acceptable to both physiotherapists and patients. In relation to the experience of adhering to an exercise programme five themes captured the nature of their experience; 'It's not easy', 'Facet's of the physio', 'Facet's of the individual', 'Physiotherapist patient relationship', and 'This really helped'.

Acceptability

One of the aims of the feasibility trial described in chapter 6 was to determine the acceptability of the AERO trial and the associated study procedures. Exploring the acceptability of interventions using qualitative methods has been previously used in physiotherapy studies. Dunphy et al (2017) used qualitative semi-structured interviews to explore the acceptability of a digital health intervention for patients after anterior cruciate ligament reconstruction, an approach similar to that

adopted for the AERO trial. Recently Sekhon et al (2017) have developed a theoretical framework of acceptability, due to limited attempts to define acceptability to date. The authors proposed a definition of acceptability as '*A multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention.'* The framework they developed consisted of several constructs, affective attitude, burden, perceived effectiveness, ethicality, intervention coherence, opportunity costs, and self-efficacy. Several of the components outlined in this new framework of acceptability were explored within the patient and physiotherapist semi-structured interviews where both parties found the study of interest and described the experience of taking part in a positive light. Patients described the various components of the trial, such as completing baseline and follow up questionnaires, and undertaking an exercise diary as appropriate, and something which was not too burdensome. Some suggestions were made for improvements or future considerations, such as improving the exercise diary, or considering a longer-term follow-up. However, these did not seem to detract from the overall acceptability of the AERO trial and its associated procedures.

Experience of adhering to an exercise programme

How patients have described adhering to an exercise programme corresponds to the way physiotherapists described exercise adherence as a challenging area of practice (chapter 4). It has already been acknowledged that changing behaviour is difficult, and this is seen in areas, such as physical activity and alcohol consumption where a large proportion of the population continue to engage in poor health behaviours (NHS Digital 2017). Specific challenges mentioned by patients included the sometimes boring nature of physiotherapy exercises. It is well known that health behaviours that individuals perceive as enjoyable encourage engagement with beneficial health behaviours (van Cappellen et al 2018). This might be something that physiotherapists could consider further, both in terms of trying to make exercise programmes as enjoyable as possible as well as regularly reviewing and changing programmes to prevent boredom creeping in.

Pain was another factor that some patients struggled with when trying to adhere to an exercise programme. A recent systematic review (Smith et al 2017) investigated whether exercise programmes for chronic MSK conditions should or should not be painful. The authors report that programmes utilising exercise into pain demonstrated a small but significant improvement in outcome compared to pain-free exercise programmes over the short-term. This is particularly important when we consider what we have known for some time that 'hurt does not equal harm' (Moseley 2007). However, on reflection it seems reasonable that patients would avoid something which is causing pain. Physiotherapists might want to consider the way that some potentially painful exercise programmes are communicated to patients, in addition to helping them appreciate a more modern view of pain science, to help facilitate better adherence to exercise.

A concern that patients described as important was who they are as a person, who their physiotherapist is as a person, and the relationship between physiotherapist and patient. It was felt important to acknowledge that everyone is an individual and will have a different perspective on exercise, that it is helpful to feel that the physiotherapist is supportive and wants the best for you, and that both patient and physiotherapist are able to work well together. Campbell et al (2001) undertook a qualitative study exploring adherence to physiotherapy for those with knee OA and

found that loyalty to the physiotherapist was cited as a reason for adherence, at least in the short-term. As far back as 2005 rapport and therapeutic alliance in health care were highlighted as important for treatment adherence (Leach 2005), and it has subsequently been argued that the benefits of a strong therapeutic alliance include adherence (Bennett et al 2011). This has also been specifically discussed in the field of MSK physiotherapy where improved exercise adherence has been associated with a strong therapeutic alliance (Babatunde et al 2017). This is an argument corroborated by recent qualitative data from Moore et al (2020) whose longitudinal qualitative study identified the importance of the therapeutic alliance on exercise adherence. In order to help promote better adherence to exercise, physiotherapists might want to take time to get to know the individuals that they are treating and to focus on the elements that could build a stronger therapeutic alliance. However, this is not necessarily straightforward: a meta-ethnography of health care professionals experience of treating chronic pain (Toye et al 2018) identified 'navigating the patient-clinician borderland' as a theme that described the complexity of negotiating the wishes of the clinician and the wishes of the patient, when they may not always match.

Finally patients spoke about the factors that they found helped them to adhere to their exercise programme. These included monitoring and feedback, which were described as useful for keeping track of what they had done, and for receiving feedback relating to what they were trying to achieve. A review by Room et al (2017) found that interventions categorised in the feedback and monitoring domain of the BCTTv1 demonstrated positive results for improving exercise adherence for older people. Therefore this may be an area where physiotherapists could focus when attempting to facilitate exercise adherence. Another aspect that patients found helpful, was understanding why they were being asked to undertake their exercise programme, so that they were not just performing a 'disembodied' task that somebody else had asked them to do. One of the domains of the COM-B model, is psychological capability (Michie et al 2011) and this would include understanding why the behaviour or task is important. An understanding of 'why' has been noted to be important in other areas of behaviour change, including breaking up sitting time in the workplace (Ojo et al 2019) and increasing hearing aid use in adults (Barker et al 2016). Finally they discussed the benefit of seeing a difference with their exercise programme. Bandura (1977) argued that performance accomplishment or mastery of experiences can improve self-efficacy. It may be that the improvement patients experience gives a sense of performance accomplishment that increases self-efficacy, in turn, making it more likely that a patient will continue with their exercise programme.

7.5.1 Limitations

This study included patient participants from both treatment arms and those with a range of scores for SEE and TFI. However, even with the range of participants included, it is still possible that there were some participants, not included in the sample, who did not find the intervention and associated study procedures acceptable. An alternative approach could have been considered, such as gathering information from all participants, using questionnaires or surveys. This approach was not considered as it would be unlikely to provide such rich data as that generated by a qualitative interview approach. However, the possibility remains that some relevant voices have not been heard. Additionally, in terms of considering the experience of trying to adhere to an exercise programme, it is likely that those volunteering to be in a study of this nature may have been more

motivated than average. This may have painted a more positive picture than if less motivated participants could have been heard.

7.6 Conclusion

The AERO intervention and related procedures were acceptable to the trial participants, both patients, and physiotherapists. Patients outlined the potential difficulties with adhering to an exercise programme. They emphasised the importance of rapport and the therapeutic relationship, in addition to specific steps they found helpful in adhering to their exercise programmes. Physiotherapists may want to give time to building strong therapeutic relationships, consider if exercise programmes can be made more enjoyable, think about how they discuss the potential that programmes may be painful, help patients monitor their progress, offer feedback, and highlight improvements to help facilitate improved exercise adherence. When the AERO intervention is tested for effectiveness in a larger trial, it will need to maintain a strong approach to collaboration and the therapeutic alliance to remain acceptable to both patients and physiotherapists.

8 General discussion

Summary

The primary aim of this thesis was to establish whether the AERO intervention, which offers tailored exercise adherence strategies based on a brief behavioural assessment as part of a standard physiotherapy appointment, was a feasible and acceptable intervention for older people with MSK conditions. A brief summary of each chapter will be given, and the findings discussed in relation to the clinical implications and the direction of future research.

Summary of chapters

The literature review reported in chapter 2 outlined that MSK conditions are common in older adults and that there is a significant burden associated with this. Prescribed exercise is a common treatment approach for MSK conditions, but adherence to exercise programmes is poor. This makes developing effective approaches to improving adherence to exercise important.

In chapter 3 a systematic review of interventions to improve exercise adherence in older people was presented. Interventions categorised in the feedback and monitoring category of a behaviour change taxonomy demonstrated positive results for improving exercise adherence compared to controls. However, the risk of bias in studies was high preventing generalisability of these findings and there was a lack of theoretical underpinning for most interventions. This highlighted the need for the development of approaches underpinned by appropriate theory.

The qualitative study presented in chapter 4 explored physiotherapists' experience of exercise adherence and non-adherence and how it affects their practice. They described it as a challenging aspect of clinical practice and were aware of the need to face it with resilience. They discussed the importance of building rapport and spoke of the specific steps they take to facilitate better adherence yet highlighting the need for effective interventions to help clinicians in this area.

Chapters 5 and 6 describe the development and testing of the AERO intervention, developed with an Intervention Mapping approach. Its feasibility and acceptability were tested in a feasibility RCT. The AERO intervention, where tailored adherence strategies were delivered to individual patients based on a brief behavioural assessment, was found to be feasible. It could be an effective strategy for clinicians but requires testing in an adequately powered RCT.

In chapter 7 the acceptability of the AERO intervention was confirmed by physiotherapists and patients in a qualitative study. Patients also described their experience of trying to adhere to an exercise programme. They highlighted the importance of the approach of the physiotherapist, being treated as an individual and working well with the physiotherapist. Any future testing of the AERO intervention will need to maintain a strong approach to collaboration and the therapeutic alliance. A move towards any kind of didactic approach is unlikely to be acceptable to patients.

Clinical implications

Throughout the chapters in this thesis are considerations that may be of importance for clinicians. Ultimately, evidenced interventions are needed to enable clinicians to be best placed to facilitate adherence. However the quantitative and qualitative data presented in this thesis suggest

approaches that might be useful to consider. The main considerations include monitoring and feedback interventions, the potential of which was discussed in the systematic review in chapter 3 (Room et al 2017). The steps taken to provide monitoring and feedback differed in the included interventions (Cheetham et al 2004, Duncan and Pozehl 2003, Wu et al 2010), yet they all demonstrated positive effects. Similar results are presented in a systematic review exploring adherence to physiotherapy prescribed self-management strategies (Peek et al 2016). Clinicians should consider how they can monitor or facilitate self-monitoring of exercise adherence, in addition to ways of providing feedback that are suitable for the patients that they see.

One factor that was felt to be important to both physiotherapists and patients was that of the therapeutic alliance. It has been argued that the therapeutic alliance could benefit adherence in settings outside of physiotherapy, such as physician-patient alliance having a positive effect on adherence to treatment for lupus (Bennett et al 2011). This has also been reported in the physiotherapy literature. In their qualitative study exploring exercise adherence in low back pain Dean et al (2005) discuss the importance of rapport and therapeutic relationship to promote adherence to exercise. Babatunde et al (2017) conducted a scoping review of the therapeutic alliance in MSK physiotherapy and occupational therapy. They concluded that one of the possible benefits to a strong therapeutic relationship is better exercise adherence. An argument corroborated by Moore et al (2020) in their longitudinal qualitative study. They report that the therapeutic alliance or the quality of the alliance seems to help adherence to exercise and physical activity in older patients with knee pain and this should be an important target in future interventions. The data from both qualitative studies in this thesis is in line with the arguments made for the therapeutic alliance. It also formed part of the AERO intervention, and would feature in any future version of the intervention to be trialled in a RCT. Therefore, clinicians should take steps to enhance the therapeutic alliance as part of an overall approach to facilitating exercise adherence.

An associated topic that was represented in the qualitative data of this thesis was the need to treat people as individuals with regards to exercise adherence. The numerous factors or personal determinants associated with adherence to exercise for older people are outlined in chapter 2 (section 2.2.2) and chapter 5 (section 5.3.1 and figure 5.2). This suggests that a one size fits all approach is unlikely to work, particularly if a behaviour may require focus in multiple domains as suggested by the COM-B model (Michie et al 2011). In the area of behaviour change, NICE (2014) also recommends tailoring interventions so that they meet the needs of the individual. One of the premises of the AERO intervention was the ability to tailor strategies to the individual, an approach that has been found to be feasible within a standard physiotherapy appointment (chapter 6). Physiotherapists may want to consider how they can take time to find out more about the individual, and then tailor any adherence approaches specifically to them.

Strengths

The strengths of the individual work packages have been discussed in the various chapters of this thesis. The general strengths are the use of different methodologies to explore the area of exercise adherence for older people with MSK conditions. This thesis has presented data from a systematic review of RCTs, qualitative data related to patient and physiotherapist experience of exercise adherence, qualitative data related to the acceptability of a newly designed exercise adherence intervention, and quantitative data related to both the acceptability and potential for effectiveness

of this intervention. In addition to this, the methodological design of the studies discussed has been rigorously undertaken. A number of methodological and reporting guidelines have been used including PRISMA (Liberati et al 2009), TIDieR (Hoffmann et al 2014), COREQ checklist (Tong et al 2007), and CONSORT guidelines (Eldridge, Chan, et al 2016).

Limitations

The limitations of the studies undertaken are outlined in the relevant chapters of this thesis. However, general limitations include the use of self-reported measures of exercise adherence, without an objective measure. The lack of valid and reliable outcome measures has been reviewed previously (Bollen et al 2014), and self-reported adherence measures such as exercise diaries have had their reliability questioned (Nicolson et al 2018). Valid and reliable measures are still needed to ensure that there can be confidence that interventions showing an affect are actually changing adherence. Ideally, an objective measure of adherence to exercise would have been used, such as inertial sensors (Bavan et al 2019) or accelerometery (Nicolson et al 2018), but due to limited resources this was not possible. When the AERO intervention is trialled in an appropriately powered RCT an objective measure of exercise adherence should be considered.

It was not possible to establish the effectiveness of the AERO intervention. Although adherence outcome measures were collected and presented, the feasibility study was not designed to test effectiveness and all outcomes related to effectiveness that are presented in this thesis should be considered in this context. Now that feasibility and acceptability has been established the AERO intervention can be tested for effectiveness in an adequately powered RCT

The development of the intervention could also have been improved. The AERO intervention was developed using an intervention mapping approach (Bartholomew Eldredge et al 2016) which allowed for the consideration of relevant information from the literature and stakeholder engagement. However, it may have been improved by hearing from a wider range of voices, particularly those who may not have been heard during the process. For example, the use of a patient group who may find adherence challenging, alongside a group who seem to demonstrate good adherence to exercise programmes may have been beneficial. In addition, during the intervention development process, the views of physiotherapy assistants and technicians could have been sought in order to improve the representativeness of the sample used.

Future research

Following the studies undertaken as part of this thesis the author has a number of recommendations for the direction of any future research. Firstly, research into valid and reliable outcome measures should continue. The problems with measuring adherence to exercise has been discussed at various points in preceding chapters and steps should be taken to design and use robust outcome measures for use in clinical and research settings.

Secondly, there is need for evidence-based theoretically underpinned exercise adherence interventions for older people with MSK conditions, but also for other populations and conditions where exercise is prescribed as part of their treatment. The AERO intervention is an example of such an approach, but the effectiveness of any intervention needs to be tested to give clinicians robust strategies to help facilitate adherence to exercise.

Finally, it is important to establish the effect that adhering to exercise and adherence interventions has on health outcomes. The need to facilitate improved adherence is only of use if it ultimately benefits patients. It has been found that adherence to exercise can improve outcomes in older people with MSK conditions, such as hip and knee OA (van Gool et al 2005, Pisters et al 2010), or in frail older people (Fairhall et al 2016). However this effect needs to be established in a broad range of MSK and other conditions, particularly if different populations have specific factors that relate to exercise adherence, and future research could target this.

Conclusion

The studies discussed in this thesis build on the knowledge of exercise adherence in the literature. They highlight the lack of theoretically underpinned interventions to improve adherence to exercise for older people with MSK conditions. It has been demonstrated that both clinicians and patients find exercise adherence a challenging topic however, the AERO intervention, using individually tailored exercise adherence strategies based on a brief behavioural assessment, within a standard physiotherapy session is feasible and acceptable. The results presented generate further questions that should be the focus of future research. Amongst them is the need to trial the AERO intervention in an adequately powered RCT to examine its effectiveness, along with the requirement to develop valid and reliable adherence outcome measures. The pragmatic approach of the intervention makes it possible to trial in the area of exercise adherence for older people, but also potentially in other areas where exercise adherence is important for health outcomes.

9 References

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10 List of appendices

1) Data extraction form
2) BCTT categories and specific BCTs
3) Interview and focus group topic guide
4) COREQ checklist
5) Example of coding
6) 1st order codes
7) Grouping codes into subthemes process
8) Themes, subthemes and codes
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Appendix 1

Data Extraction 1 - Study Characteristics

Study Number: …… Reviewer: ……

Title: ……

Authors…… Journal, Date: ……

Item	Topic (Paper Section)	Domain	Assessment			Description/ Comments
			Yes	No	Unclear	
1	**Design** Title & Abstract	**How participants were allocated to interventions**				
2	**Background** Introduction	**Background and study rationale**				
3	**Objectives** Introduction/Methods	**Specified objectives and hypotheses**				
4	**Participants** Methods	**Eligibility criteria**				
		Sample size How was sample size determined? Number recruited Number analysed				
		Sex (number, %) Men Women				
		Age Mean, SD, range				
		Diagnosis What were participants being given exercise for?				
		Secondary outcomes(s)				
10	**Interpretation** Discussion	**Interpretation of Evidence** Interpretation of results, taking into account potential bias Generalisability				
11	**Conclusion**	**Study conclusions** Findings in context current evidence (put this in appropriate context – e.g. behaviour change wheel)				
5	**Setting** Methods	**Location** Of intervention – home, face to face in hospital etc. Of data collection				
6	**Intervention** Methods	Intervention described? Type of intervention e.g CBT Duration of intervention				
7	**Comparison** Methods	**Control Intervention** Describe (type, dose, intensity, frequency)				
8	**Outcomes** Methods	**Outcomes pre-specified?** Defined primary and secondary outcomes?				
		Outcome Measures Used Primary Secondary				
		Timeline of assessments				
9	**Results** Results	**Recruitment** Dates of recruitment and follow-up				
		Baseline Data Baseline characteristics presented for each group?				
		Compliance with Intervention monitored? Please state (this is the main outcome)				
		Adverse Events All important adverse events or side effects in each group				
		Summary of Results Mean, effect size, 95% (CI), SD **Primary outcome**				

Appendix 2

Behaviour Change Techniques as grouped by the Behaviour Change Taxonomy (Michie et al 2013)

Behaviour Change Techniques in the Behaviour Change Taxonomy by groups	
1) Goals and Planning ○ **Goal setting (behaviour)** ○ **1.2 Problem solving** ○ **1.3 Goal setting (outcome)** ○ **1.4 Action planning** ○ **1.5 Review behaviour goal(s)** ○ **1.6 Discrepancy between current behaviour and goal(s)** ○ **1.7 Review outcome goal(s)** ○ **1.8 Behavioural contract** ○ **1.9 Commitment**	**2) Feedback and Monitoring** ○ 2.1 Monitoring of behaviour by others without feedback ○ 2.2 Feedback on behaviour ○ 2.3 Self-monitoring of behaviour ○ 2.4 Self-monitoring of outcome(s) of behaviour ○ 2.5 Monitoring of outcome(s) of behaviour without feedback ○ 2.6 Biofeedback ○ 2.7 Feedback on outcome(s) of behaviour
3) Social Support ○ **3.1 Social support (unspecified)** ○ **3.2 Social support (practical)** ○ **3.3 Social support (emotional)**	**4) Shaping Knowledge** ○ 4.1 Instruction on how to perform the behaviour ○ 4.2 Information about antecedents ○ 4.3 Re-attribution ○ 4.4 Behavioural experiments
5) Natural consequences ○ **5.1 Information about health consequences** ○ **5.2 Salience of consequences** ○ **5.3 Information about social and environmental consequences** ○ **5.4 Monitoring of emotional consequences** ○ **5.5 Anticipated regret** ○ **5.6 Information about emotional consequences**	**6) Comparison of behaviour** ○ 6.1 Demonstration of the behaviour ○ 6.2 Social Comparison ○ 6.3 Information about others' approval
7) Associations ○ **7.1 Prompts/cues** ○ **7.2 Cue signalling reward** ○ **7.3 Reduces prompts/cues** ○ **7.4 Remove access to the reward** ○ **7.5 Remove aversive stimulus** ○ **7.6 Satiation** ○ **7.7 Exposure** ○ **7.8 Associative learning**	**8) Repetition and substitution** ○ 8.1 Behavioural practice/rehearsal ○ 8.2 Behaviour substitution ○ 8.3 Habit formation ○ 8.4 Habit reversal ○ 8.5 Overcorrection ○ 8.6 Generalisation of target behaviour ○ 8.7 Graded tasks

9) Comparison of outcomes ○ **9.1 Credible source** ○ **9.2 Pros and cons** ○ **9.3 Comparative imagining of future outcomes**	**10) Reward and threat** ○ 10.1 Material incentive (behaviour) ○ 10.2 Material reward (behaviour) ○ 10.3 Non-specific reward ○ 10.4 Social reward ○ 10.5 Social incentive ○ 10.6 Non-specific incentive ○ 10.7 Self-incentive ○ 10.8 incentive (outcome) ○ 10.9 Self-reward ○ 10.10 Reward (outcome) ○ 10.11 Future punishment
11) Regulation ○ **11.1 Pharmacological support** ○ **11.2 Reduced negative emotions** ○ **11.3 Conserving mental resources** ○ **11.4 Paradoxical instructions**	**12) Antecedents** ○ 12.1 Restructuring the physical environment ○ 12.2 Restructuring the social environment ○ 12.3 Avoidance/reducing exposure to cues for the behaviour ○ 12.4 Distraction ○ 12.5 Adding objects to the environment ○ 12.6 Body changes
13) Identity ○ **13.1 Identification of self as role model** ○ **13.2 Framing/reframing** ○ **13.3 Incompatible beliefs** ○ **13.4 Valued self-identity** ○ **13.5 Identity associated with changed behaviour**	**14) Scheduled consequences** ○ 14.1 Behaviour cost ○ 14.2 Punishment ○ 14.3 Removal reward ○ 14.4 Reward approximation ○ 14.5 Reward completion ○ 14.6 Situation-specific reward ○ 14.7 Reward incompatible behaviour ○ 14.8 Reward alternative behaviour ○ 14.9 Reduce reward frequency ○ 14.10 Remove punishment
15) Self-belief ○ **15.1 Verbal persuasion about capability** ○ **15.2 Mental rehearsal of successful performance** ○ **15.3 Focus on past success** ○ **15.4 Self-talk**	**16) Covert learning** ○ 16.1 Imaginary punishment ○ 16.2 Imaginary reward ○ 16.3 Vicarious consequences

Appendix 3

Topic guide for physiotherapists interviews and focus group

Questions regarding experience of exercise adherence

1. 'What are your experiences of exercise adherence with your patients?'
2. 'Is there any difference if you are seeing older patients?'
3. 'How does thinking about exercise adherence affect your practice?
4. 'Are there any aspects of talking about something like adherence that is challenging? Is there anything about it that seems to be outside of your role or scope of practice?
5. 'Are there any steps you take to improve exercise adherence in your patients? Can you describe them?'
6. 'Do you feel that they are effective?'
7. 'What do you feel are some of the common barriers that your patients experience?'

Appendix 4

COREQ checklist for *'Physiotherapists' perceptions of how adherence and non-adherence to recommended exercise affects their practice: A qualitative study'.*

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	43
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	43
Occupation	3	What was their occupation at the time of the study?	42
Gender	4	Was the researcher male or female?	43
Experience and training	5	What experience or training did the researcher have?	43
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	43
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	43
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	43
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	42
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	42
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	42
Sample size	12	How many participants were in the study?	43
Non-participation	13	How many people refused to participate or dropped out? Reasons?	n/a
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	43
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	n/a
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	44
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	appendix 3
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	n/a
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	43
Field notes	20	Were field notes made during and/or after the inter view or focus group?	43
Duration	21	What was the duration of the inter views or focus group?	43
Data saturation	22	Was data saturation discussed?	n/a
Transcripts returned	23	Were transcripts returned to participants for comment and/or	n/a

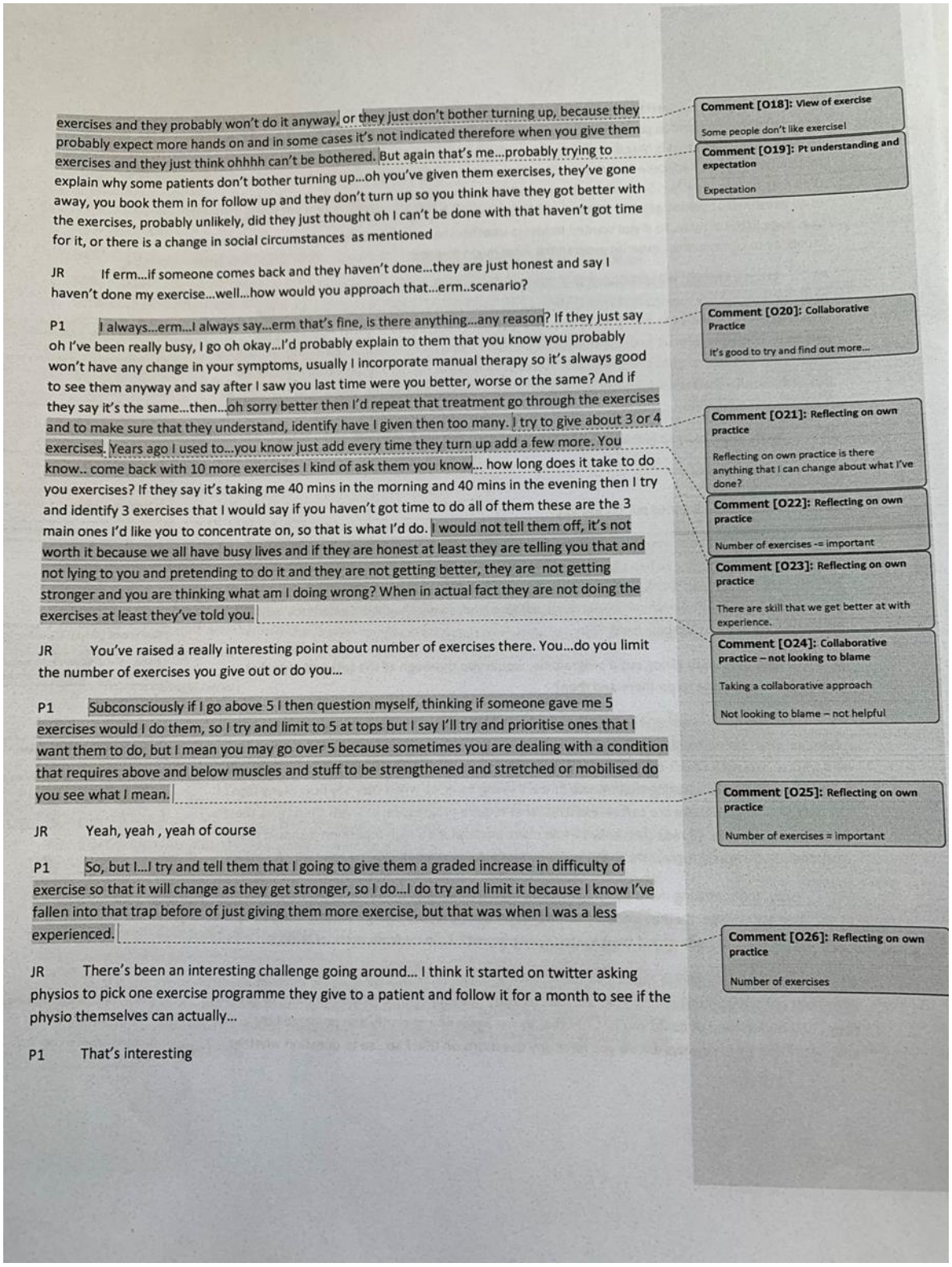
Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	43
Description of the coding tree	25	Did authors provide a description of the coding tree?	Appendix
Derivation of themes	26	Were themes identified in advance or derived from the data?	43
Software	27	What software, if applicable, was used to manage the data?	43
Participant checking	28	Did participants provide feedback on the findings?	n/a
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	44-49
Data and findings consistent	30	Was there consistency between the data presented and the findings?	44-49
Clarity of major themes	31	Were major themes clearly presented in the findings?	44-49
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	44

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

Appendix 5

An example of coding from two transcripts, highlighted sections related to parts of the transcripts that were felt to be of interest on initial reading. The text in the comment boxes in normal font (not bold) relate to the generation of the initial codes and idea. The text in bold in the header of each comment box represent sub-themes that initial codes were group into at a later date.



exercises and they probably won't do it anyway, or they just don't bother turning up, because they probably expect more hands on and in some cases it's not indicated therefore when you give them exercises and they just think ohhhh can't be bothered. But again that's me...probably trying to explain why some patients don't bother turning up...oh you've given them exercises, they've gone away, you book them in for follow up and they don't turn up so you think have they got better with the exercises, probably unlikely, did they just thought oh I can't be done with that haven't got time for it, or there is a change in social circumstances as mentioned

JR If erm...if someone comes back and they haven't done...they are just honest and say I haven't done my exercise...well...how would you approach that...erm..scenario?

P1 I always...erm...I always say...erm that's fine, is there anything...any reason? If they just say oh I've been really busy, I go oh okay...I'd probably explain to them that you know you probably won't have any change in your symptoms, usually I incorporate manual therapy so it's always good to see them anyway and say after I saw you last time were you better, worse or the same? And if they say it's the same...then...oh sorry better then I'd repeat that treatment go through the exercises and to make sure that they understand, identify have I given then too many. I try to give about 3 or 4 exercises. Years ago I used to...you know just add every time they turn up add a few more. You know.. come back with 10 more exercises I kind of ask them you know... how long does it take to do you exercises? If they say it's taking me 40 mins in the morning and 40 mins in the evening then I try and identify 3 exercises that I would say if you haven't got time to do all of them these are the 3 main ones I'd like you to concentrate on, so that is what I'd do. I would not tell them off, it's not worth it because we all have busy lives and if they are honest at least they are telling you that and not lying to you and pretending to do it and they are not getting better, they are not getting stronger and you are thinking what am I doing wrong? When in actual fact they are not doing the exercises at least they've told you.

JR You've raised a really interesting point about number of exercises there. You...do you limit the number of exercises you give out or do you...

P1 Subconsciously if I go above 5 I then question myself, thinking if someone gave me 5 exercises would I do them, so I try and limit to 5 at tops but I say I'll try and prioritise ones that I want them to do, but I mean you may go over 5 because sometimes you are dealing with a condition that requires above and below muscles and stuff to be strengthened and stretched or mobilised do you see what I mean.

JR Yeah, yeah , yeah of course

P1 So, but I...I try and tell them that I going to give them a graded increase in difficulty of exercise so that it will change as they get stronger, so I do...I do try and limit it because I know I've fallen into that trap before of just giving them more exercise, but that was when I was a less experienced.

JR There's been an interesting challenge going around... I think it started on twitter asking physios to pick one exercise programme they give to a patient and follow it for a month to see if the physio themselves can actually...

P1 That's interesting

Comment [O18]: View of exercise

Some people don't like exercise!

Comment [O19]: Pt understanding and expectation

Expectation

Comment [O20]: Collaborative Practice

It's good to try and find out more...

Comment [O21]: Reflecting on own practice

Reflecting on own practice is there anything that I can change about what I've done?

Comment [O22]: Reflecting on own practice

Number of exercises -= important

Comment [O23]: Reflecting on own practice

There are skill that we get better at with experience.

Comment [O24]: Collaborative practice – not looking to blame

Taking a collaborative approach

Not looking to blame – not helpful

Comment [O25]: Reflecting on own practice

Number of exercises = important

Comment [O26]: Reflecting on own practice

Number of exercises

but kiwis are very active (JR: yeah), cause that's just what they all do. (JR: Sure.) But, the politics and the government around that really encourage outdoor, busy lifestyles.

JR: So, it's easier to get someone on board with any kind of exercise if that's their cultural norm.

EF: Yeah (JR: Yeah), I'm thinking you know ****'s just come back from China, and there's dedicated areas in the park where the old people go, and they've got special stones, so the old people can do their own reflexology. They've got lower bars, so they can do their arm exercises and then there's the teenagers part of the park which obviously more body weight resisted, more ??? (10.20). And so that's the government helping them and but, they've always had it, that they all go to the park and do tai chi together, I think (JR: yeah, no no no there's a whole section of questions around that) so therefore it becomes habitual. (JR: ...that we'll get to in a bit, but yeah absolutely, when I get round to talking about the intervention, there's a section that we'll think around some of those things) Okay, yep. (JR: what's it like when...) So not very helpful then am I? (JR: No, that's good, that's really good).

JR: What's it like when someone comes to you, they haven't done any of the stuff and you say how's it going, and it's clear they haven't done any thing you've asked, how does that feel?

EF: I'm... me personally, I'm getting better at saying 'well, I've done my job' so I don't take it so personally anymore. But, in terms of the patients, erm, I will probably say 'well, is that the case?' Do some objective measurements' cause if the first...if the first statement was 'oh, I'm no better but having said that, I've not done my exercises, I'll say 'well let's do an assessment and see where we're at' cause sometimes, nature of recovery, people do get better on their own and they don't necessarily had to have done the exercises, so I think, looking for the silver lining, I think is important, so my initial response is okay, there must be something that I can feed out, so I'll do my objective measures and say 'oh look, even though you've not engaged, look your range of movements better' or 'oh look your grip strengths better' or 'oh, you know, you said before you weren't going to the shops and you've just said you went to the shops'. You know what I mean? (JR: yeah). So, I think even though they've not done their exercises, the fact that they've still turned up says to me there is an element of wanting to engage and they do want to get better (JR: just because they're there or, yeah okay). Erm, but, I will wrap it up at the end of the session with what are you gonna do that's different, what's your action plan? Or what's our action plan depending on... (JR: yes, okay).

JR: So you said before, you're getting better at saying 'well, I've done my job', so what would you have done in the past if someone came back...?

EF: I would've been like throw more exercises at them or... doubted myself cause was there something in me (JR: yeah) that made them not want to engage?

JR: And you want them to get better, that's why you do the job that you do.

EF: Yeah, but now I'm like you know... I'm not taking it so personally if they haven't bought my experience and bought my skills, I've realised.

JR: I wonder how many physios would say that, cause I think I would feel that way. Okay, there's some really helpful stuff in there, so the intervention we're thinking of designing is a brief pragmatic prompt for clinicians to do a mini-behavioural assessment, erm and it's underpinned by the COM-B, the behaviour change wheel and COM-B basically says that for a person to perform... to undertake a behaviour, they need to capability, opportunity and

Comment [O11]: **Adherence is about more than the patient/individual**

Behaviour change is about more than just the individual – exercise and adherence affected by social norms, political influences, family influence/support

Comment [O12]: **Adherence is about more than the patient/individual**

Culture matters! And that is hard to change!

Comment [O13]: **Adherence is about more than the patient/individual**

Therefore exercise is a habit – making stuff a habit is about more than just ourselves

Comment [O14]: **Avoid the desire to fix, you can't do it for them**

And

Frustration (or opposite of)

And

Need to be resilient

I've learned to let go?? Sound like in the past they did take it personally..

Comment [O15]: **Motivation**

The fact that they have turned up shows some engagement/some motivation

Comment [O16]: **How do we communicate**

Action plan, what are you going to do from now on?

Comment [O17]: **Reflecting on own practice**

What have I done wrong, do I just need to give them more stuff?

Comment [O18]: **Need to be resilient**

It's not my fault?

Appendix 6

This is a list of initial 1st order codes generated after coding transcripts

- **Experience is variable –** Pt report experience of adherence as variable
- **Importance of adherence** - It can make or break treatment
- **Patient expectation and understanding –** What do they think, it matters
- **Why are they doing what they are doing?** – do they know why they are exercising
- **Why have you given them what you have given them? –** What are the reasons you selected what you did?
- **Against the quick fix?** – Are they looking for a quick fix
- **Could they explain it to someone else? -** The importance of patient expectation and understanding is outlined by physiotherapists
- **Work place culture -** What practices are normal where you work
- **Goal setting** – it is important
- **What is the reason/motivation behind the goal, why is it a goal?, linked to personal outcome)** - working towards a goal is described as importance by physiotherapists – gives physio and patient direction
- **Collaborative practice –** we need to work with the patient
- **Not looking to blame –** It doesn't work
- **Need to treat the individual –** treat the person in front of you
- **What is important to the patient -** Working with the patient is seen as key
- **Habits –** What is normal for them
- **problem solving -** We need to help pts solve problems that stop adherence
- **Motivation –** This is important in relation to adherence
- **what is the motivation behind the goal** – why that goal what motivates them
- **We can't predict the future -** The tricky aspect, exercise like any physiotherapy treatment is not a silver bullet! It is hard to both convince the patient that exercise is THE treatment, but then to also be honesty that sometime it won't work for some people…
- **Perceived barriers – (Time, pain, social situation, finances, co-morbidities, motivation, quick fix)**
- **View of exercise -** Some people don't like exercise! It can be boring!
- **Reflecting on own practice –** What can I do?
- **Communication –** The way we talk and listen is important
- **Numbers –** Number of exercises given out is seen as important
- **Exercise prescription** – We need to get this right
- **Pressure am I engaging this person** – it can feel like hard work
- **Adherence is about more than the patient/individual –** socio economics, population – older people more sedentary, family all play a part
- **Default position –** The way we are has an effect anyway, e.g. are we motiving
- **The need to sell exercise as a treatment/or how do we sell exercise /selling exercise)** –how we 'sell' our treatment is important - linked to goal, functional
- **Hard to measure adherence (It's about more than just numbers)** – what even is adherence?
- **We need to be honest about how challenging it is -** we have to be upfront about how difficult it is to stick to an exercise programme – especially if patients feel like they have to give us the 'right' answer
- **It's a problem we all face** – It's a human thing with all sorts of stuff, much bigger than just exercise
- **something is better than nothing –** even a small amount can be seen as good

- **short-term pain long term gain – (?prospect theory?))** – The time can make it a hard sell
- **We need to know the patient/individual** – we need to know who they are and what makes them tick
- **Self-efficacy** – seen as an important construct/trait
- **Monitoring and feedback –** seen as important
- **Tailor to the individual** – what you give need to suit the individual
- **Importance of monitoring/review** – it's easier to change behaviour with more contacts/time
- **Avoid the desire to fix, you can't do it for them –** we can't do there exercise for them however much we can try to help
- **fostering self-management** – the patient needs to manage the condition themselves ultimately
- **Encouraging long-term change** – Short-term change is easier but long term change may be needed
- **Difficult to facilitate behaviour change in a limited timeframe** – we need time and contacts
- **How do we communicate?** – what we say is important
- **importance of the language we use** - what we say is important
- **Frustration –** Wasting time seeing someone who isn't participating in rx
- **You feel stuck** – I don't know where to go?
- **Dishearting** – makes my job difficult
- **difficult –** changing behaviour is difficult
- **easy to blame yourself –** There must be more I can do
- **Exercise can be social** – Exercise can be fun especially with others in groups
- **Need to work with a BPS approach (treating the whole person)** – Just treating a knee or a should will not help foster good adherence
- **When you help someone it is just the best feeling** –helping people change is great!
- **Age and the perception of time** – Age can affect what we want to do, and/or achieve
- **Need to be resilient** – we can only help we can't do it for them, if they don't change we need to be resilient and move on
- **Using data** – using data can help competition if only with self

Appendix 7

This shows the process of grouping 1st order codes into subthemes and eventually themes. Codes were printed out on separate bits of paper and grouped into similar categories, these categories became subthemes and were similarly grouped into themes.

Appendix 8

This shows the first attempt at categorising themes, subthemes and 1st order codes. Themes are in bold as headings, subthemes are listed below each theme, 1st order codes are in brackets after each subtheme. In this first example there are 5 themes, each with 4 subthemes. After review and discussion between authors, this was reduced to 4 themes and some subthemes were combined with others.

1) The challenge of exercise adherence

Participants described the challenges exercise adherence presents in their everyday practice.

1. **Adherence is about more that the individual** (Adherence is about more than the patient/individual and It's a problem we all face)
2. **Short-term pain for possible long term gain?** (Short-term pain long term gain – and We can't predict the future)
3. **Adherence hard to quantify and hard to achieve** (Experience is variable and Importance of adherence and Hard to measure adherence and difficult to facilitate behaviour change in a limited timeframe)
4. **The reason the challenge is worth it** (When you help someone it is just the best feeling)

2) The effect of the challenge

Participants described what effect this challenge had on them and their professional identity

1. **It's so frustrating!** (Frustration and Dishearting)
2. **Makes my job difficult** (Difficult and you feel stuck)
3. **Pressure** (Pressure am I engaging the person, Easy to blame yourself)
4. **There is a need to be resilient** (Need to be resilient)

3) Striving to see the individual

Participants recognised the importance of understanding and treating the individual in relation to exercise adherence

1) I need to know the individual (We need to know the patient/individual, What is the reason/motivation behind the goal, why is it goal?, Why are they doing what they are doing, Habits, What is important to the patient)
2) **The expectations and understanding of the individual** (Patient expectations and understanding , View of exercise, could they explain it to someone else)
3) Perceived barriers
4) **I try to tailor treatment** (Tailor to the individual, Need to treat the individual)

4) Reflecting on own practice in the face of the challenge

Participants described the steps they have taken or want to take in their practice in relation to dealing with exercise adherence

1) **Collaborative practice** (Collaborative practice, Communication, How do we communicate, Importance of the language we use, not looking to blame)
2) **We need to be honest about how challenging it is** (We need to be honest about how challenging it is, Default position, Something is better than nothing)
3) **Avoid the desire to fix** (Avoid the desire to fix, you can't do for them, Against the quick fix, Fostering self-management, Need to work with a BPS approach (treating the whole person))
4) **I need to try to sell exercise** (The need to sell exercise as a treatment/or how we sell exercise/selling exercise)

5) My tool kit

Participants described the tools that they used to foster better adherence

1) **Fostering self-efficacy and motivation** (Self-efficacy, Motivation, What is the motivation behind the goal)
2) **Clinical reasoning** (Why have you given the what you have given them, Exercise prescription, Numbers)
3) **Goal Setting (Goal setting)**
4) **Over coming barriers** (problem solving, monitoring and feedback, importance of monitoring review)

Appendix 9

AERO Trial – Action Plan

- What steps will I take to do my exercise programme?

- What things might get in the way of doing my exercises?

- What is the plan to overcome these?

- What will I do if I miss some of my exercises?

- Why am I doing these exercise in the first place – what is my goal?

Appendix 10

AERO Trial – Decision Balance Sheet

What may happen if I undertake my exercise programme?	What may happen if I don't undertake my exercise programme?

Why am I doing my exercise programme in the first place, what are my goal(s)?

Appendix 11

AERO Trial – Behavioural Contract

- What are my goal(s)?

- How will my exercise programme help me to meet my goal(s)?

- Where will I undertake my exercise programme?

- What time of day will I undertake my exercise programme?

- Is there anyone who can help me with my exercise programme?

I agree to undertake my exercise programme as agreed with my physiotherapist.

Date

Signed Participant Physiotherapist

Appendix 12

AERO Trial – Goal Setting Review

What is my goal(s)?

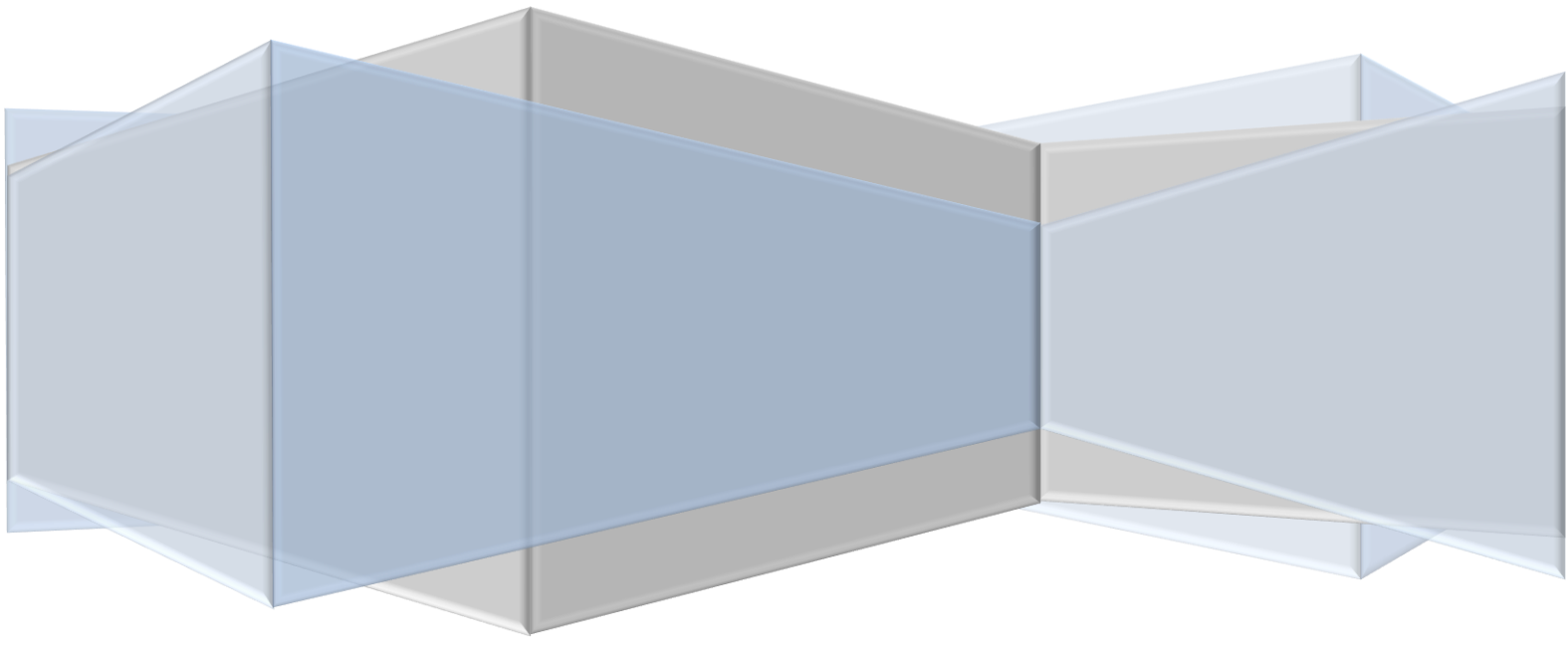
How will my exercise programme help me to achieve my goal(s)?

Exercise	How it will help me achieve my goal(s)
1.	
2.	
3.	
4.	
5.	

Appendix 13

Adherence for Exercise Rehabilitation in Older people (AERO) trial

Helping you stick to your exercise programme



Exercise Diary

This section contains an exercise diary. Please can you record the number of exercises you have done. Write each exercise on a separate line in the diary and record the number of sets and repetitions you have done each day. For example if you were asked to perform squats and some calf raises, for 10 repetitions, 3 sets a day (in other words 3 times a day), the physiotherapist will record this in the first 3 columns of the exercise diary. The next 7 columns represent the days of the week, for each day please record the number of sets and repetitions you have completed. In the example below the participant completed 2 sets of 10 repetitions for both exercises every day, except for Saturday when no exercises were undertaken. There are enough diaries starting on the next page to cover 12 weeks.

Please don't worry if you haven't done your full amount or even any exercise, we just want an honest account of the exercise undertaken. We know that it is hard for all of us to stick to a programme, so give an accurate account of your exercise programme in the diary. If you want to provide any comments for any week, there is a comments box after the week 12 diary.

Example diary

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Squats	10	3	*2 X 10*	*2 X 10*	*2 X 10*	*2 X 10*	*2 X 10*	-	*2 X 10*
Calf raises	10	3	*2 X 10*	*2 X 10*	*2 X 10*	*2 X 10*	*2 X 10*	-	*2 X 10*

Week 1

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 2

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 3

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 4

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 5

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 6

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 7

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 8

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 9

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 10

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 11

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Week 12

Exercise	Reps	Sets	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Comments Box

If you have any comments relating to your exercises or exercise diary please record them in this box.

Section 4: Useful Contacts

- Principle investigator: Jonathan Room
  Telephone 01865 737673 or 01865 737526

- Physiotherapy Department Nuffield Orthopaedic Centre
  Telephone: 01865 738074

- Patient Advice and Liaison Service, Nuffield Orthopaedic Centre
  Telephone: 01865 738126
  Email: PALS@ouh.nhs.uk

Appendix 14

Consort checklist taken from Eldridge SM, Chan CL, Campbell MJ, Bond CM, Hopewell S, Thabane L, et al. CONSORT 2010 statement: extension to randomised pilot and feasibility trials. BMJ. 2016;355.

CONSORT 2010 checklist of information to include when reporting a pilot or feasibility trial*

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a pilot or feasibility randomised trial in the title	84
	1b	Structured summary of pilot trial design, methods, results, and conclusions (for specific guidance see CONSORT abstract extension for pilot trials)	N/A
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale for future definitive trial, and reasons for randomised pilot trial	Chapter 5
	2b	Specific objectives or research questions for pilot trial	84
Methods			
Trial design	3a	Description of pilot trial design (such as parallel, factorial) including allocation ratio	84
	3b	Important changes to methods after pilot trial commencement (such as eligibility criteria), with reasons	n/a
Participants	4a	Eligibility criteria for participants	85
	4b	Settings and locations where the data were collected	88
	4c	How participants were identified and consented	84-85
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	85- and chapter 5
Outcomes	6a	Completely defined prespecified assessments or measurements to address each pilot trial objective specified in 2b, including how and when they were assessed	87-88
	6b	Any changes to pilot trial assessments or measurements after the pilot trial commenced, with reasons	n/a
	6c	If applicable, prespecified criteria used to judge whether, or how, to proceed with future definitive trial	n/a
Sample size	7a	Rationale for numbers in the pilot trial	91
	7b	When applicable, explanation of any interim analyses and stopping guidelines	n/a
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	91
	8b	Type of randomisation(s); details of any restriction (such as blocking and block size)	91
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	n/a

Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	91
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how	n/a
	11b	If relevant, description of the similarity of interventions	n/a
Statistical methods	12	Methods used to address each pilot trial objective whether qualitative or quantitative	91
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were approached and/or assessed for eligibility, randomly assigned, received intended treatment, and were assessed for each objective	90
	13b	For each group, losses and exclusions after randomisation, together with reasons	90
Recruitment	14a	Dates defining the periods of recruitment and follow-up	90
	14b	Why the pilot trial ended or was stopped	n/a
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	94
Numbers analysed	16	For each objective, number of participants (denominator) included in each analysis. If relevant, these numbers should be by randomised group	96
Outcomes and estimation	17	For each objective, results including expressions of uncertainty (such as 95% confidence interval) for any estimates. If relevant, these results should be by randomised group	96-98
Ancillary analyses	18	Results of any other analyses performed that could be used to inform the future definitive trial	n/a
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	98
	19a	If relevant, other important unintended consequences	n/a
Discussion			
Limitations	20	Pilot trial limitations, addressing sources of potential bias and remaining uncertainty about feasibility	101
Generalisability	21	Generalisability (applicability) of pilot trial methods and findings to future definitive trial and other studies	98-100
Interpretation	22	Interpretation consistent with pilot trial objectives and findings, balancing potential benefits and harms, and considering other relevant evidence	98-100
	22a	Implications for progression from pilot to future definitive trial, including any proposed amendments	n/a
Other information			
Registration	23	Registration number for pilot trial and name of trial registry	n/a
Protocol	24	Where the pilot trial protocol can be accessed, if available	n/a
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	n/a
	26	Ethical approval or approval by research review committee, confirmed with reference number	92

Appendix 15

Topic guide for physiotherapists

1. How did you find it being part of the study?
2. What were your experiences of delivering the intervention?
3. Are there any aspects you would change?
4. What are your experiences of exercise adherence with your patients?
5. How does dealing with exercise adherence affect your practice?
6. Has this been different during or since the study?
7. What do you feel were the barriers that stop people adhering?
8. What does it feel like when somebody has not adhered at all to your advice?
9. Is there anything that would make life easier in your practice related to exercise adherence?

Appendix 16

Topic guide for patient representatives

1. How did you find it being part of the study?
2. What is it like trying to stick with an exercise programme?
3. What things make it difficult to stick to?
4. What things make it easier to stick to?
5. Did any of the things the physiotherapist suggested help?
6. If you were giving a friend advice on sticking to an exercise programme, what would you suggest?
7. What things do you think physiotherapists or other health care professionals should consider when giving people exercise programmes?
8. What does it feel like when you miss a session/day of exercise?

Appendix 17

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	103
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	103
Occupation	3	What was their occupation at the time of the study?	102
Gender	4	Was the researcher male or female?	103
Experience and training	5	What experience or training did the researcher have?	103
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	103
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	103
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	103
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	102
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	103
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	103
Sample size	12	How many participants were in the study?	103
Non-participation	13	How many people refused to participate or dropped out? Reasons?	n/a
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	103
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	n/a
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	104
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	appendix
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	n/a
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	103
Field notes	20	Were field notes made during and/or after the inter view or focus group?	103
Duration	21	What was the duration of the inter views or focus group?	103
Data saturation	22	Was data saturation discussed?	n/a
Transcripts returned	23	Were transcripts returned to participants for comment and/or	n/a

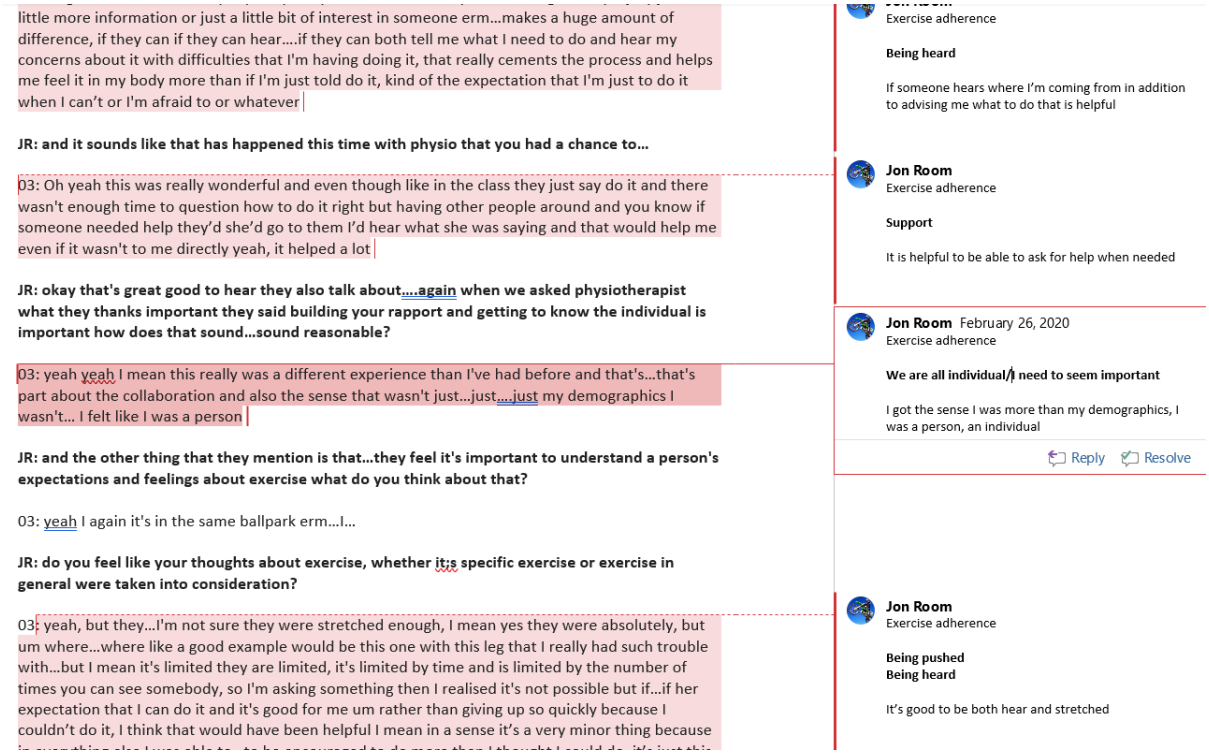
Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	103
Description of the coding tree	25	Did authors provide a description of the coding tree?	Appendix
Derivation of themes	26	Were themes identified in advance or derived from the data?	103
Software	27	What software, if applicable, was used to manage the data?	103
Participant checking	28	Did participants provide feedback on the findings?	n/a
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	104-1113
Data and findings consistent	30	Was there consistency between the data presented and the findings?	104-113
Clarity of major themes	31	Were major themes clearly presented in the findings?	104-113
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	104 + 107

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.

Appendix 18

An example of coding from two transcripts, highlighted sections related to parts of the transcripts that were felt to be of interest on initial reading. The text in comment boxes in normal font (not bold) relate to the generation of initial codes and idea. The text in bold in the header of each comment box represent sub-themes that initial codes were group into at a later date.



R09: Yes, but I also think going back a little bit part of it is a type of mentality the person has I mean I would say some things I have a tendency to be well no on a lot of things I tend to be a perfectionist verging on a OCD for example my two daughters and my son we have four cars between us and one daughter lives away but I wash the cars every week, Saturday morning I will wash my daughters car who lives next door but one, my other daughter every time she brings the car home I wash it, soon as it turns up in the drive, I'm out there with my bucket, and my cars my wife and my cars are washed a very regular basis and they are very well looked after, and the house and the garden things I keep pretty well, so I do have a perfectionist tendency which is not it's not a OCD but it's not an illness, but I'm quite fussy and in order to do that I do tend to have these routines so going to my daughters garden I can't do that every Monday morning I go round there and do it, so when you asked me to do something like these exercises It's sort of I become…I develop this routine and it's quite easy for me to do it, I can quite see if is that somebody with that mentality would probably be better at doing his exercises then somebody hasn't got that, that approach to life you know, so you are dealing with different types of people some of got more of a tendency to do it then others and somebody who hasn't got that, never wash the car, doesn't really give a damn about anything it's probably gonna be more difficult to stick to regime of this sort then somebody like myself it's just my thoughts

JR No, absolutely one of the premises of this project is to try and target strategy….strategies towards the individual that the physio seeing and they won't always be the same, because some people naturally will be maybe we might class that as motivated, 'if you ask me to do something I know that it's important I'm going to do it' and for other people it might be that they need a lot more work on that, seeing the importance of it the motivation side, for some it might be that they struggle with the opportunity to find time and a place to do it so really really motivated but they work and they have family

R09: I can see that and the other thing of course is there must be people who fudge what they say they do

JR: Of course

R09: Is that too scared to go back and tell the physiotherapist I haven't done it for a week erm and that must happen a lot and of course I guess you've got elderly people who do genuinely forget and err do I don't know how you get get around the fudging bit I mean with your diary I mean quite frankly could have ticked anything and you'd have been none the wiser. I couldn't have done anything at all

JR: I think if we moved on to a, or when we move on to a bigger scale study we need to think about how we get a more objective measure alongside that. So you said a clicker but maybe even using so form of technology

R09: No yeah

JR: Because undoubtedly people aren't completely honest but actually it's just much more helpful

Jon Room February 28, 2020
Exercise Adherence

Perception of exercise

The mentality of the person could be important, I'm a perfectionist so if you give me something to do I'll do it

Reply Resolve

Jon Room
Trial

Exercise diary/Improvements

People can lie on the diary

Jon Room
Exercise Adherence and trial

Exercise diary/Improvements

People can make up what they have done, I wonder how you get around that

Appendix 19

A list of initial 1st order codes generated after coding transcripts, first for the 'acceptability of the trial' and secondly related to the experience of adhering to an exercise programme

Acceptability of trial

It was easy

Fine

Tailored to me

Tailoring

Specific Instruction

Expectations

Exercise Diary

No Concerns

Helping Others

Physio patient relationship

Rapport

Helping out

Improvements

Signing up

Participant paperwork

Interesting

Worthwhile

Questionnaires

Diary easy to makeup

Subjective measures

I'll get looked after

Incentive

Convenience

Important

Worked well

Fitted

Strategies

Model

Relevant

Direct benefit

Behaviour change before any intervention

Challenge of working in a trial

Follow up time frames

Theory

Paperwork

Helped me think

I understand the challenge of recruiting

Experience of exercise adherence

The Physio

Adaptable

Tailor to me

The environment matters

Exercise Diary

Sticking to exercise

Structure

Pain

Seeing a difference

Contact with the physio

We are all individuals

We are all different

Clear instruction

I need to seem important

I wasn't involved

Time pressure / time

Physio patient relationship

Rapport

I felt safe

I struggle with exercise

I'm not that active

Habits

Relapse

Motivation / not just motivation

Organisation

Life can be busy

Fighting on multiple fronts

Perception of exercise

Treated well

Doing it with others/other people

Noticing lack of improvement

Mental health

History of exercise

Boring

Discipline

Belief

Being pushed

Being heard

Support

Cost benefit analysis

Hope

Guilty

Personal

Realistic

Forgetting

I'll do it later

Goals

Feedback

Communication

Tech

Reminders

Understanding why

Long term v short term

Expectation

Activity

Waiting

Working together

Monitoring

Accountability

The person

Empathy

It's hard

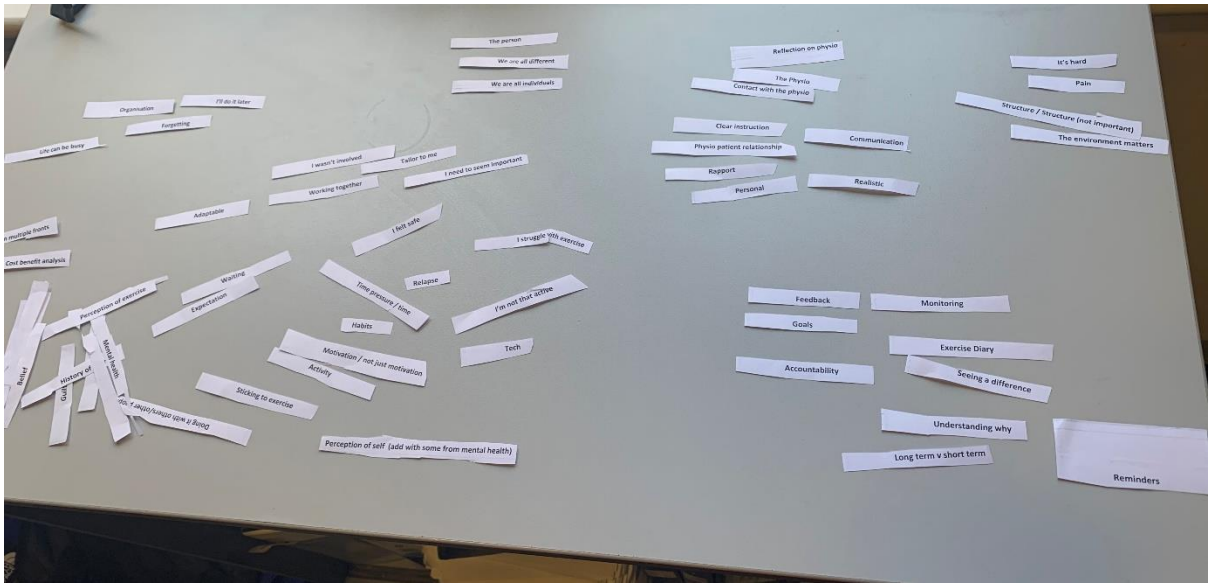
Perception of self

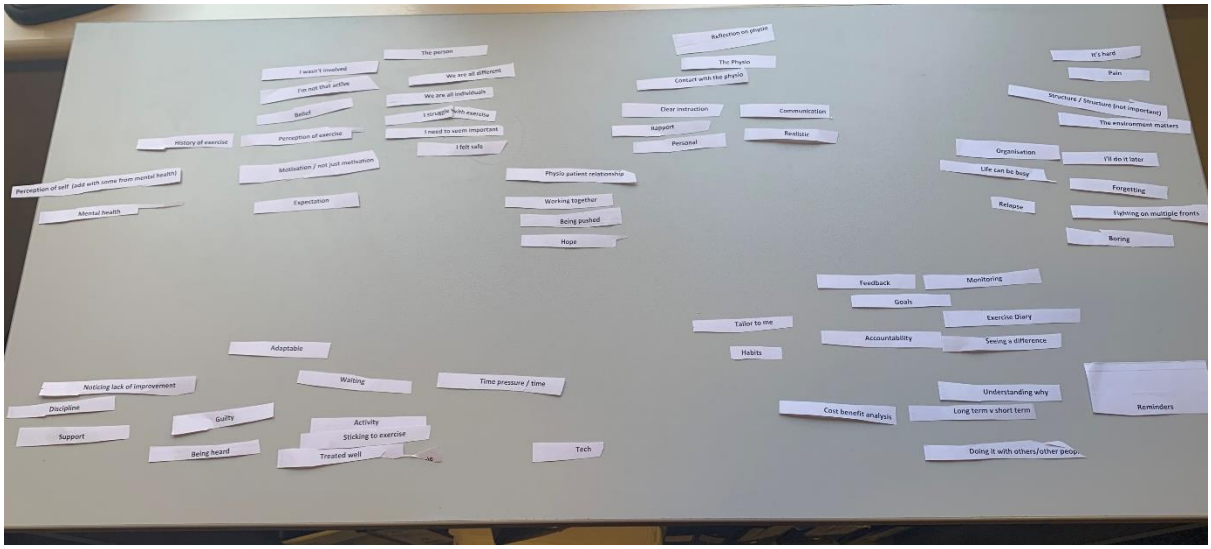
Reflection on physio

Looking forward

Appendix 20

Showing the process of grouping 1st order codes into subthemes and eventually themes. Codes were printed out on separate bits of paper and grouped into similar categories. These categories became subthemes and were similarly grouped into themes.





Appendix 21

This shows the first attempt at categorising themes, subthemes and 1st order codes. Themes are in bold as headings, subthemes are listed below each theme, 1st order codes are in brackets after each subtheme. This is shown first for acceptability of the AERO study, and then separately for experience of adhering to an exercise programme. The section on acceptability, is more descriptive and so there are less 1st order codes per subtheme compared with the analysis for participants experience.

1) I signed up because

Participants describe why they signed up to the AERO study, and physiotherapist outlined why they agreed to take part

1) To help others (signing up/helping others)
2) Understand the need (helping out/I understand the challenge of recruiting)
3) I'll get looked after (I'll get looked after/Direct Benefit)
4) Important and interesting (Important/interesting/relevant)

2) Experience of taking part

Participants and physiotherapist described what it was like being part of the AERO study

1) Worthwhile (Worthwhile/Convenience)
2) Easy (Fine/It was easy)
3) Fitted (fitted/worked well)
4) Helped me think (helped me think)

3) The components

In this theme specific components of the trial were discussed, this include trial paperwork for participants, and the underlying theory and approach for physiotherapists

1) Instruction (specific instruction)
2) Dairy (Exercise diary)
3) Questionnaires (questionnaires)
4) Theory (Theory/model/strategies)
5) It can be tailored (tailored to me/tailoring)
6) Paperwork (paperwork)

4) Considerations for the future

This theme included suggestions for improvements or considerations for any future version of the AERO study or intervention

1) Paperwork amendments (participant paperwork)
2) Diary limitations (diary easy to make up, subjective measures)
3) Longer follow ups (follow up timeframes)
4) Behaviour change before the intervention (behaviour change without intervention/incentive)

1) It's not easy

In this theme participants describe the challenge of adhering to an exercise programme

1) A hard task (It's hard/guilty)
2) Routine (Structure/Organisation/Time/Time pressure/Life can be busy/The environment matters)
3) Challenges (Boring/Pain/Fighting on multiple fronts/noticing lack of improvement/relapse)

2) Facets of the physio

Participants discuss the importance of who their physiotherapist was, how the physiotherapist made them feel, and how they communicated about exercise.

1) The physio (Reflection on physio/support/belief/empathy/personal)
2) Communication (communication/clear instruction/rapport /realistic/adaptable/Contact with physio

3) Facets of the person

Participants described the importance of who they were, their perceptions of self, and their feelings about exercise.

1) Who I am (The person/We are all different/We are all individuals/Perception of self/Mental health)
2) My relationship with exercise (I struggle with exercise/History of exercise/ I'm not that active/activity/Perception of exercise/Sticking to exercise/Expectation)
3) What I need (I need to seem important/I felt safe/I need to feel safe/I wasn't involved/ discipline/I'll do it later/forgetting/Motivation / not just motivation)

4) Physiotherapist patient relationship

Participants spoke of the importance of the physiotherapist and the patient coming together to work jointly

1) Working together (Working together/physio patient relationship)
2) Being heard (Treated well/being heard/being pushed/accountability)
3) Hope (Hope/looking forward)

5) This really helped

Participants describe things that they found helpful for adhering to exercise

1) Monitoring and feedback (Monitoring/Feedback/Exercise diary/Reminders)
2) Seeing a difference (Seeing a difference/goals)
3) Understanding why (Understanding why/Long term v short term/ Cost benefit)